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HANDBOOK
OF
PHARMACOGNOSY

BY

OTTO A. WALL, M.D., PH.G.

Professor of Materia Medica, Pharmacognosy and Botany in the St. Louis College of Pharmacy; Member of the Committee for Revision of the Pharmacopœia of the United States, 1880-1890 and 1890-1900; Second Vice-President of the Convention for the Revision of the United States Pharmacopœia from 1900-1910; Presiding Officer of the United States Pharmacopœia Convention of 1910; One of the Authors of the "Companion to the United States Pharmacopœia;" Author of "Lessons in Latin," "The Prescription," etc.

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PREFACE

The object of this book is mainly to serve as notes on pharmacognosy (Waarenkunde) for students in colleges of pharmacy, for students preparing for state board of pharmacy examinations, and for the everyday exigencies of the retail pharmacist.

No student can listen to a course of lectures and derive full benefit therefrom unless he makes memoranda of the most salient features of the lectures. On the other hand, many teachers maintain that while the student is making note of some fact or other, he will give superficial attention or miss altogether something else about which the lecturer is meanwhile speaking, so that the advantage of "taking notes" is offset by the information lost while taking them. This handbook is intended to take the place of notes which a diligent student might possibly write down for himself, so that during the lectures he can give undivided attention to the words of the lecturer, and to the illustrations and specimens shown.

This handbook also serves as a skeleton of the science of pharmacognosy, presenting only those main facts which a student should make an effort to remember, and around which he can later gather and arrange further knowledge that may be acquired in post-graduate study; irrelevant descriptions and illustrations of plants from which drugs are derived, etc., are therefore omitted, and the illustrations represent the drugs themselves, as far as possible, in natural size, and are intended to take the place of a collection of drugs as nearly as possible. Histological details that are not necessary in recognizing (crude) drugs are not made prominent, and many of the sections represent the appearance that can be observed with the naked eye, or by aid of a simple lens magnifying from five to ten diameters, and by reflected light; the structure which can thus be seen is sufficient to enable one to identify the drugs, and this is, therefore, all that is necessary or of direct practical use in pharmacognosy.

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As the description of a drug and its recognition by its physical characteristics is in no degree dependent on its recognition as "official" in a pharmacopoeia, no mention is made of its being "official" or merely "officinal;" in this regard this handbook applies equally well to *any* pharmacopoeia, or to *all* pharmacopoeias. As every student of pharmacy must have his pharmacopoeia, that is where he must seek the information whether a drug is official or not; the pharmacognosist, *as a pharmacognosist*, is not interested in this question; he is interested only in the question whether a drug occurs in the drug trade or not.

The system adopted is based on the general principles of modern pharmacognosy as established and first published in Europe by Schleiden and Berg, and in this country by Maisch; but in many details the arrangement is original. The numbering of the groups, and the short synopsis at the head of each group, has been found of great practical value and convenience in the actual work done with the aid of this system by the students in the author's own classes.

The author submits the book to the kind consideration of the pharmaceutical public with the hope that it may contribute towards popularizing the study of pharmacognosy and lead many to become interested in this useful branch of knowledge.

O. A. WALL.

St. Louis, 1917.

PHARMACOGNOSY

INTRODUCTION

The medical profession is divided into two branches: physicians who prescribe for the sick, and pharmacists who dispense the medicines. This division of labor has existed for thousands of years, probably because experience has taught that this arrangement is better and safer than when the same person prescribes and dispenses also.

To heal the sick has always been the aim of the medical profession. Healing the sick presupposes an organism which is endowed with life, and the physician must study both the organism and its environments in order that he may intelligently treat any departure from health.

Certain rudimentary studies are necessary for all learned men, whatever their professions may be. These studies are comprised in the phrase, "good, common school education" (better still, "collegiate education"), and include the "three R's," grammar, history, geography (including physical geography), physics or natural philosophy and the rudiments of the Latin language.

The studies of special interest to the medical profession are—

Physics—Chemistry—Microscopy

$$\text{Organism in Health}\begin{cases}\text{Structure: }\textbf{Anatomy.}\\ \text{Action: }\textbf{Physiology}\begin{cases}\text{Coarse.}\\ \text{Microscopical }\textbf{(Histology).}\end{cases}\end{cases}$$

$$\text{Organism in Disease}\begin{cases}\text{Structure: }\textbf{Pathological Anatomy}\begin{cases}\text{Coarse.}\\ \text{Microscopical.}\end{cases}\\ \text{Action: }\textbf{Pathology.}\\ \text{Treatment: }\textbf{Pharmacology.}\end{cases}$$

FUNDAMENTAL STUDIES

Physics or **Natural Philosophy** treats of the mechanical laws and molecular forces. There is no absolute line of distinction between this study and—

Chemistry, which treats of the atomic constitution of matter and explains the composition of all material things and the changes that may take place in the atomic combinations.

Microscopy is not, strictly speaking, a science, but rather an art, because it teaches the use of the microscope and its various accessories, but the knowledge it imparts is not of use only to the medical profession, but is of equal value to every scientist and of interest to every educated person.

These three studies may be called the foundation on which is to be built up the superstructure of a thorough scientific education in any department of physical sciences.

SPECIAL STUDIES

Anatomy teaches the structure of living organisms; human anatomy treats of the organs and structure of the human body. There is no sharp limit between "coarse anatomy" (structures that can be seen with the unaided eye) and "microscopical anatomy," or "histology," (requiring the use of the microscope) and this division is one mainly of convenience.

Histology treats of the microscopical or cellular structure of living organisms. Human histology, therefore, treats of the cellular elements and tissues of the human body.

Physiology treats of the processes of life—healthy organisms; in health the various cells, tissues and organs act harmoniously together. In youth assimilation of food exceeds waste and the organism grows until it reaches maturity; then for a time assimilation and waste balance each other, until age approaches, when waste gradually gains over assimilation, the tissues lose their vigor and a gradual decay sets in which finally results in death from old age. This is the healthy, normal destiny of the living organism.

Histology and physiology are so intimately related to each other that it is impossible to treat of one without speaking of the other, and the two branches of study are therefore usually taught together.

When the normal harmony of action in the body is disturbed, we call the resulting condition "disease."

Pathological Anatomy is the study of the changes that are produced in the normal anatomy by the processes of disease; some of these changes are macroscopic and can be seen with the unaided eye, while the changes in the minuter structures, as in cells or tissues, require the aid of the microscope for recognition; this latter is generally referred to as "cellular pathology." Pathological anatomy is the anatomy of the body in disease.

Pathology bears the same relation to pathological anatomy that physiology has to normal anatomy. It describes the actions of the organs or tissues in disease.

Any or all of these branches of study may be subdivided or specialized according to the needs of the physician.

The physician must know the human body in health so that he may recognize those departures from the normal that constitute sickness. He is thus enabled to make a *diagnosis*, i. e., he can say what is the nature of the abnormal or diseased condition. The *prognosis* is the foretelling of the probable course of the disease.

But the object of all study on the part of physicians and pharmacists is to cure the patient, and the treatment of disease requires a knowledge of—

Pharmacology, the science of remedies and remedial measures. It is a comprehensive term and in its widest sense includes the study of everything that has, or is supposed to have, or that can have any influence in curing disease in every possible aspect; an inquiry into the efficacy or inefficacy of prayers or laying on of hands is as legitimately within the scope of pharmacology as a study of the source, preparation or action of calomel or quinine. The term *Materia Medica* is often used as a synonym for pharmacology, but a fairer distinction of the term would limit its application to material things, to "medical materials."

The term "pharmacology" is frequently applied wrongly to a study of the action of drugs and medicines, which latter study is properly named "pharmaco-dynamics."

Pharmacology demands a knowledge of several important subsidiary branches of knowledge.

- Pharmacology (Materia Medica)
  - **Chemistry**
    - Theoretical.
    - Practical.
  - **Pharmacognosy**
    - **Zoölogy.**
    - **Botany.**
    - **Microscopy.**
  - **Pharmacy**
    - Theoretical.
    - Practical.
  - **Pharmaco-Dynamics**
    - General
    - Special
    - } **Therapeutics.**

While anatomy, physiology, pathology, etc., are of more interest to the physician, a general knowledge of these studies is also necessary for the pharmacist so that he may more fully understand those branches of the medical science which more closely concern him. A student of pharmacy should acquire at least as much knowledge on these subjects as can be obtained from the careful study of some good college physiology, which treats of these subjects in a simple, plain and compendious manner.

The scheme of studies enumerated under Pharmacology is of direct and great importance to the pharmacist, even more so than to the physician, with the single exception of pharmaco-dynamics, which is of greater importance to the physician and of subordinate use to the pharmacist.

Chemistry and Microscopy we have already considered. In colleges of pharmacy these studies are not only of as general a nature as in technical schools, but are taught with additional special reference to the pharmacists' work.

Medicines are material substances, which may either be taken into the system or applied locally, and which, when in contact with living tissues, can alter the action of cells or tissues in such a manner as to cure disease. What may at one time and in one dose be a medicine, may under other circumstances or in a different dose prove to be a *poison.*

Medicines are prepared from organic or inorganic materials. We often read the sign "DRUGS AND CHEMICALS." Chemistry, as taught in colleges of pharmacy, treats of the general science, and of the individual inorganic and synthetic *chemicals* that are used as medicines.

Pharmacognosy is the knowledge of *drugs;* drugs are the organic substances used in medicine and in the arts in the crude form in which they are brought into trade. Pharmacognosy

teaches us how to recognize or identify drugs and how to determine their quality.

Drugs are of either animal or vegetable origin. A study of animal drugs, requires some knowledge of zoölogy, but as the animal drugs are of subordinate value or importance, zoölogy need not be studied to any great extent. Vegetable drugs are of vastly greater importance and therefore a knowledge of

Botany is necessary to an understanding of pharmacognosy. The pharmacognosist must be able to recognize the part of plant which constitutes the drug, and he must not only be familiar with its coarse but also with its microscopical structure, and the value of a study of *microscopy* for the pharmacognosist cannot be exaggerated; in fact, pharmacognosy in the modern sense is an impossibility without a knowledge of microscopical technology and of the cellular constitution of plants, or structural botany.

Pharmacy is the science, art and business of preparing, compounding and dispensing medicines. Pharmacists constitute a learned profession because they must study a wide scope of sciences or studies in order to qualify themselves for their calling; pharmacy as a profession is not inferior to medicine, and the medieval arrogant conceit of a pharmacist being "ye handemayden," or "ye cooke" of "ye physician" ceased to have sense or meaning centuries ago. The tendency of modern times is specialization, and the pharmacist is a specialist in the medical profession in the same sense as the surgeon, the oculist, the gynecologist or any other specialist; the specialist is not superior, neither is he inferior, to the general practitioner, but they all belong to the same profession, with equal honors, each working in his particular sphere, doing his special work for the amelioration and cure of pain and sickness.

Pharmacy is an art because theoretical knowledge alone will not make a man a good pharmacist but he must have acquired the necessary manipulative skill in laboratory work and in dispensing. We have therefore a branch of theoretical pharmacy or of the *Principles of Pharmacy,* and another of *Practical Pharmacy* or Pharmaceutical Laboratory Work. Pharmacy in its dealings with the public is a business, subject to the commercial laws that govern and control business in all other directions.

Business tact and talent are therefore as necessary as theoretical and practical professional training, to insure success.

Pharmaco-Dynamics treats of the actions or effects of remedies, of the power or force or influence of all remedial measures. *General pharmaco-dynamics* treats of the action of groups of medicines, as for instance of cathartics, antiperiodics, tonics, etc., while *special pharmaco-dynamics* treats of the actions of individual medicines, and enables us to choose the particular one remedy or combination of remedies that seems to be most appropriate in any given case. Pharmaco-dynamics investigates the action of remedies on the healthy as well as on the sick body, so that the action of a remedy may be understood in all possible bearings.

The application of all the knowledge of the physician for the purpose of giving relief or of curing disease in the case of the individual patient is **Therapeutics**, a branch of pharmaco-dynamics that treats of the use of remedies in the concrete individual cases that a physician is called to attend. Therapeutics is the culmination, the end and aim of all medical studies, and in the widest and fullest sense such studies as *Surgery, Obstetrics, Gynecology*, or the use of medicines, baths, electricity, etc., are merely specialized branches of Therapeutics, of the Art of Curing or Healing.

The pharmacist, then, must thoroughly study **Chemistry**, (theoretical and practical), **Botany** (structural and microscopical), **Microscopy, Pharmacy** and **Pharmacognosy**, and moderately thoroughly also **Pharmaco-Dynamics**, including **Posology**, or the doses of medicines, and in addition he should acquire rather more than a mere superficial knowledge of *Biology and Zoölogy, Anatomy, Physiology,* and *Pathology;* in other words, the educated, thoroughly qualified pharmacist must be a learned professional man.

CLASSIFICATIONS

In the prosecution of any study it is absolutely necessary to adopt *some system*. A haphazard random memorizing of isolated facts is of little value because the facts are not utilizable unless their relation to each other is fully understood.

Therefore, in order to study drugs and medicines we must adopt some method of classification. We may adopt any of the following methods, or in fact, adopt several for different purposes—

Alphabetical.
Botanical { Natural orders alphabetically arranged. / Natural orders according to natural system.
Zoölogical.
Chemical.
Physiological.
Therapeutical.
Physiological and Therapeutical Combined.
Organoleptic Properties.
Physical Characteristics.

The Alphabetical Classification is best adapted for works of reference and is used in the *Pharmacopoeia* and in the various commentaries, as in the *Dispensatories.* The system has no scientific merit, but is the best and only one adapted for convenience and rapidity of reference.

Botanical Classifications are of interest because they group drugs according to their family affinities, all the drugs derived from any one class of plants being enumerated together. While this system has a little value in an abstract scientific sense, it is of little or no practical value to the pharmacist or physician, as botanical affinities do not argue therapeutical affinities or pharmaceutical similarities. For instance: the *Rubiaceæ* furnish both cinchona and ipecac; the *Leguminosæ* yield a heterogeneous jumble of drugs dissimilar in physical nature as well as in medicinal activities, as gum arabic, senna, catechu, balsam of tolu, logwood, Calabar bean, cassia fistula, red saunders, licorice root, broom, tamarind and balsam of peru, representing the therapeutical groups of lenitives, laxatives, astringents, cathartics, blennorrhetics, narcotics, and coloring agents, and the physical groups of gums, extracts, balsams, fruits, roots, wood, leaves and flowering tops; from the *Umbelliferæ* we derive anise, asafœtida, and conium, etc.

This whole subject is of such subordinate value to the pharmacist, that students are advised not to devote much time to trying to memorize the classes of plants from which the various drugs are derived, if this must be done at the expense of practical and more important subjects of study.

Some works classify the natural orders of plants according to a "natural system," while in other works on drugs based on botanical classification the orders of plants are arranged alphabetically.

As drugs are not in condition to be classified botanically, or to

be assigned to their botanical classes, this method of grouping them is of absolutely no value to the pharmacist or pharmacognosist.

If the animal drugs were of more importance, we might be justified in adding a **Zoölogical Classification**; to the extent that these drugs are spoken of such a classification is in use, but it is of course of very inferior importance and of limited applicability.

Chemical Classifications, more or less comprehensive, are used for special purposes, as for instance in pharmacy when the drugs are arranged in groups according to their constituents, with reference to the menstrua that are needed to exhaust them in making tinctures, fluid extracts, etc.

Physiological Classifications are based on the actions of medicines as determined by experiments on lower animals or on healthy human beings. While the action as thus determined is not always the same as, or even similar to the action of the same drug when administered to a sick person, the facts found by physiological researches and experiments explain the manner of the action of medicines and suggest the rational and more scientific use of the remedies.

Therapeutical Classifications are based on the actions of medicines in disease. The knowledge of the action of remedies has been obtained in the past, largely by accident or empiricism, and many absurdities were believed until modern systematic physiological research placed the study of therapeutics on a more rational basis. Still, even now, the mode of action of many remedies and the valuable results obtained by the administration of these medicines to the sick, are but imperfectly or not at all understood, and the administration of these drugs and their preparations continues to be based on the accumulated empirical experiences of the past and present.

But while a therapeutical classification is not as strictly scientific as some of the others, it is of great value to the physician, and is very valuable for the purpose of the therapeutist, and some therapeutical system of classification of medicines should be studied by every pharmacist as well. There are very many different systems of this kind, almost every author on therapeutics having modified previous systems to suit his own theories.

Perhaps the most valuable system of classification for the physi-

cian is one based on the **combined physiological and therapeutical** consideration of medicines. In other words, a careful study of the empirical knowledge and experience of the ages by the light of modern scientific methods, gives us the best and most practical systems of classification of medicines for clinical use.

A system of this kind, practically based on Headland's work on the action of drugs, is presented for study a little farther on.

The grouping of drugs according to their **organoleptic properties** (odor, taste, or even color) was properly and scathingly ridiculed by Schleiden, the originator of modern pharmacognosy, yet it has been made quite prominent again in recent times;—modern systematic pharmacognosy is intended to enable us to identify or recognize *unknown drugs* from a description of the same; therefore, the descriptions of drugs should be in words that convey some idea about their properties, which cannot be done in regard to their organoleptic properties. For instance, we cannot describe, *in words*, what "sweet" or "sour" means, to one who has not experienced such tastes before; we cannot describe, *in words*, the difference between the "sweetness" of cane sugar and maple sugar, between the "sourness" of vinegar and lemon juice, or the difference in the "aromas" of vanilla and cardamom, or anise and fennel; therefore, while an *experience* of such tastes or odors may be a very great aid in recognizing again *previously known* drugs, no good verbal description in regard to previously unknown tastes or odors can be given, and therefore such characteristics should not be made important in modern works of pharmacognosy, even though it is advisable for every student of pharmacognosy to taste and smell every drug. Least of all should organoleptic properties be made the basis of a classification of drugs, as has been done by some recent authors.

We have learned that Pharmacognosy is the knowledge of *drugs* and that it teaches us how to recognize and identify drugs and how to determine their quality. The systems of classifications already mentioned are of little or no assistance for this purpose and another method must be adopted.

Physical Characteristics are made the basis of a system of classification whose introduction raised Pharmacognosy to be a methodical and accurate science. When we see a drug that is not known to us, we examine it carefully to find what it is;

suppose it is a root this determination at once eliminates from the consideration of what it possibly can be all the drugs that are not roots and narrows us to a choice among a comparatively small number of drugs. This is what the physician would call "diagnosis by exclusion."

We make a transverse section of the drug and examine the smooth cut surface with a lens, or we may make a microscopical section and examine that, to determine whether it is a mono-cotyledonous or di-cotyledonous root. As we can observe nearly all the facts required for identification by examining a smooth section with a low-power lens, and by reflected light, it is not necessary to make or figure cleared sections showing cellular details. Many drawings in this book show merely what a small lens, or even the unaided eye, can see by reflected light. If we find our specimen to be of di-cotyledonous structure, we determine next whether it is a fleshy or woody root, and if the latter, whether it has a thick or thin bark; if it is either a woody root with a thick bark, or a fleshy root, we look for oil, resin or latex ducts, because we subdivide into groups *with* or *without* such ducts. Now we have probably reduced the number of drugs which the one under examination can be to a half dozen or less, and we can soon determine which one of this small number it really is. Or if we find the drug to be a leaf or flower, a bark or wood, or anything else, we proceed in a similar manner to narrow the choice to a very few names, from which it is easy to select the correct one.

This is what is meant by a system of Pharmacognosy based on physical characteristics.

As the main object of systematic pharmacognosy is to enable us to recognize and identify *unknown* drugs, it follows that the characteristics taken notice of in such a system must be such as can be recognized in any *unknown* drug; therefore the physical characteristics which can be recognized by our physical senses (mainly sight and touch) are most important. For instance, to classify volatile oils as derived from leaves, flowers, fruits, etc., is absurd, because we cannot recognize this in an *unknown* volatile oil; we must first identify the oil and then ascertain such facts from a book.

Therapeutical Classification

Innumerable systems of therapeutical classification have been proposed; it is impossible to devise a system of any kind of classification which shall be open to no objection; we see a weak place in one system and we attempt to better it only to find that it necessitates changes elsewhere that are more objectionable than the faults we attempted to correct. The best system, therefore, remains a compromise, and it differs from other systems mainly because one author places more stress on one feature of the subject, another author more on some other feature.

The following therapeutical system of classifications is given merely for the purpose of giving a general idea of the subject, and not because it is better than dozens of others, any one of which might have been used as well as an illustration:—

CLASS I. HAEMATICS OR BLOOD REMEDIES.

DIVISION I. RESTORATIVES.

Order 1. Aliments or Foods.
" 2. Acids.
" 3. Alkalies.
" 4. Tonics.
" 5. Chalybeates (Iron).
" 6. Solvents.

DIVISION II. CATALYTICS, OR ALTERATIVES.

Order 1. Antiphlogistics.
" 2. Antisyphilitics.
" 3. Antiscrofulosa.
" 4. Antiarthritics.
" 5. Antiscorbutics.
" 6. Antiperiodics.
" 7. Anticonvulsives.
" 8. Antisquamosa.

CLASS II. NEUROTICS OR NERVE REMEDIES.

DIVISION I. STIMULANTS.

Order 1. General Stimulants.
" 2. Specific Stimulants.

DIVISION II. NARCOTICS.

Order 1. Inebriants.
" 2. Somniferants.
" 3. Deliriants.

DIVISION III. ASTRINGENTS.

Order 1. Mineral Astringents.
" 2. Vegetable Astringents.

CLASS III. ELIMINANTS OR EVACUANTS.

Order 1. Sialagogues.
" 2. Expectorants.
" 3. Emetics.
" 4. Cathartics.
" 5. Cholagogues.
" 6. Diaphoretics.
" 7. Diuretics.

CLASS IV. TOPICAL OR LOCAL REMEDIES.

It is outside of the purpose of this book to go into any farther detail in regard to this subject. The meaning of the words, as far as they are not self-explanatory, can be learned from any medical dictionary, or the student may study these and other therapeutical terms in the list of therapeutical terms on page 612 of this book.

Classification According to Physical Characteristics

This method of classification deals only with *drugs*, which are the organic substances used in medicine and the arts in the crude form in which they are brought into trade. They are grouped according to their derivation from animals or plants, and secondarily according to whether or not they show *organic* or *cell* structure.

- Drugs
  - Animal
    - Showing cell-structure.
    - Showing no cell-structure.
  - Vegetable
    - Showing cell-structure.
    - Showing no cell-structure.

Animal Drugs

- Showing cell-structure
  - Whole animals
    - Mature.
      - Worms.
      - Insects.
    - Immature; Eggs.
  - Parts of animals
    - Soluble in alcohol or water.
    - Insoluble in alcohol or water.
- Showing no cell-structure
  - Solid.
  - Semi-solid.
  - Liquid.

Vegetable Drugs

- Showing cell-structure
  - Whole plants or flowering tops, sufficiently complete for botanical determination.
  - Parts of Plants.
    - Cryptogams.*
    - Roots.
    - Rhizomes.
    - Tubers or Corms.
    - Bulbs.
    - Twigs or Branches.
    - Piths.
    - Woods.
    - Barks.
    - Leafbuds.
    - Leaves.
    - Flowers.
    - Fruits.
    - Seeds.
    - Parts of plants not easily recognizable.
- Showing no cell-structure
  - Showing definite granules under microscope.
  - Amorphous.†
    - Acids.
    - Juices and Extracts.
    - Sugars.
    - Gums.
    - Gum-resins.
    - Resins.
    - Oleo-resins.
    - Balsams.
    - Volatile oils.
    - Fixed oils.
    - Peculiar concrete substances.
    - Coloring matters.

The cellular vegetable drugs are grouped as follows:—

Whole Plants or Flowering Tops.

- **Cryptogams**
  - Thallogens
    - Algae.
    - Lichens.
    - Fungi.
  - Acrogens
    - Lycopodiaceæ.
    - Equisetaceæ.
    - Ferns.

- **Roots**
  - Mono-cotyledonous.
  - Di-cotyledonous
    - Woody with thin bark.
    - Woody with thick bark
      - with ducts.‡
      - without ducts.‡
    - Fleshy
      - with ducts.‡
      - without ducts.‡

---

*The Cryptogams, many of which are really whole plants, are placed here on account of the difficulty of classifying them botanically.

†A few of these amorphous substances contain mechanically incorporated debris of cellular elements.

‡Oil, resin or latex ducts or special large cells.

- **Rhizomes**
  - With rootlets
    - Mono-cotyledonous.
    - Di-cotyledonous
      - with ducts.*
      - without ducts.*
  - Without rootlets
    - Cryptogamous.
    - Mono-cotyledonous
      - elongated.
      - short, compact.
    - Di-cotyledonous
      - elongated.
      - short, compact.
- **Tubers** or **Corms**
  - Whole.
  - Sliced.
- **Bulbs**
  - Whole.
  - Sliced.
- **Twigs** or **Branches**
  - Leafy.
  - Scaly.
  - Naked.
- **Piths.**
- **Woods**
  - White.
  - Colored.
- **Barks**
  - Whole
    - Bast with isolated bast-cells.
    - Bast radially striated.
    - Bast tangentially striated.
    - Bast quadratically striated.
    - Bast without striation.
  - Rasped.
- **Leaf buds.**
- **Leaves**
  - Coriaceous
    - Simple.
    - Compound.
  - Herbaceous
    - Simple.
    - Compound.
- **Flowers**
  - Whole Inflorescences
    - Racemose or cymose.
    - Compound flower-heads
      - Unopened.
      - Expanded.
  - Single flowers
    - Whole
      - Unopened.
      - Expanded.
    - Parts of flowers
      - Corollas.
      - Stigmas.
- **Fruits**
  - Fresh
    - Spurious.
    - Fleshy.
    - Stone Fruits.
  - Dried or Prepared
    - Spurious.
    - Dry.
    - Fleshy.
    - Stone fruits.
  - Parts of Fruits.
- **Seeds**
  - Whole.
  - Cotyledons only.
  - Arilli, or seed-coats.
- **Parts of Plants** not easily recognizable as such.
  - Whole.
  - Cut, or otherwise altered.
  - Trichomes.
  - Excrescences.

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*Oil, resin or latex ducts or special large cells.

We find that this gives us the following groups, numbered consecutively:—

1. Worms.
2. Insects.
3. Eggs. (Immature forms of animals.)
4. Parts of animals wholly or partly soluble in alcohol or water.
5. Parts of animals not soluble in alcohol or water.
6. Solid non-cellular animal substances.
7. Semi-solid amorphous animal substances.
8. Liquid amorphous animal substances.
9. Plants or flowering tops, sufficiently complete for botanical determination.
10. Algæ.
11. Lichens.
12. Fungi.
13. Lycopodiaceæ.
14. Equisetaceæ.
15. Ferns.
16. Mono-cotyledonous roots.
17. Woody di-cotyledonous roots with thin bark.
18. Woody di-cotyledonous roots with thick bark and with oil, resin or latex ducts.
19. Woody di-cotyledonous roots with thick bark, but without oil, resin or latex ducts.
20. Fleshy roots with oil, resin or latex ducts.
21. Fleshy roots without oil, resin or latex ducts.
22. Mono-cotyledonous rhizomes with rootlets.
23. Di-cotyledonous rhizomes with rootlets and with oil, resin or latex ducts.
24. Di-cotyledonous rhizomes with rootlets but without oil, resin or latex ducts.
25. Cryptogamous rhizomes without rootlets.
26. Mono-cotyledonous rhizomes without rootlets, long as compared with the diameter.
27. Mono-cotyledonous rhizomes without rootlets, short and compact.
28. Di-cotyledonous rhizomes without rootlets, long as compared with the diameter.
29. Di-cotyledonous rhizomes without rootlets, short and compact.
30. Whole tubers or corms.
31. Sliced tubers or corms.
32. Whole bulbs.
33. Sliced bulbs.
34. Twigs with leaves attached.
35. Scaly twigs.
36. Naked twigs.
37. Piths.

38. White woods.
39. Colored woods.
40. Barks which show isolated bast-cells on transverse section.
41. Barks with the bast radially striated.
42. Barks with the bast tangentially striated.
43. Barks with the bast quadratically striated.
44. Barks with no striation of bast.
45. Rasped bark, so that sections cannot be made.
46. Leaf buds.
47. Simple coriaceous leaves.
48. Compound coriaceous leaves.
49. Simple herbaceous leaves.
50. Compound herbaceous leaves.
51. Racemose or cymose inflorescences.
52. Unopened compound flower-heads.
53. Expanded compound flower-heads.
54. Unopened single flowers.
55. Opened single flowers.
56. Corollas.
57. Stigmas.
58. Spurious fruits, fresh.
59. Fleshy fruits, fresh.
60. Stone-fruits, fresh.
61. Dried or prepared spurious fruits.
62. Dry fruits.
63. Dried or prepared fleshy fruits.
64. Dried or prepared stone-fruits.
65. Parts of fruits.
66. Whole seeds.
67. Cotyledons only.
68. Seed-coats or Arilli.
69. Whole vegetable substances, in which the plant-part is not always easily determined.
70. Cut or otherwise altered plant substances in which the plant-part is not always easily determined.
71. Trichomes, or epidermal outgrowths.
72. Excrescences or morbid outgrowths.
73. Granular substances which show no cell-structure, but show regular and definite structure under the microscope.
74. Acids.
75 and 76. Juices and Extracts.
77. Sugars.
78. Gums.
79. Gum-resins.
80. Resins.
81. Oleo-resins.
82. Balsams.

83. Volatile oils.
84. Fixed oils.
85. Peculiar concrete substances.
86. Coloring matters.

METHOD OF STUDY

In studying the individual drugs we do not limit ourselves to a consideration of pharmacognosy alone but study several other things about them. By adopting a method we will be less apt to overlook or forget facts of importance, and a plan similar to the following is usually adopted:—

- **Name.**
- **Origin.**
- **Habitat.**
- **Description.**
  - Shape.
  - Size.
  - Color.
  - Fracture.
  - Structure;
    - *Coarse;*
    - *Microscopical.*
  - Odor.
  - Taste.
- **Constituents.**
- **Uses;**
  - Action;
  - Dose.

Name (N.).—First the pharmacopoeial or pharmaceutical title, then the scientific English name; next common English names, or synonyms.

Origin (O.).—Nature and source of the drug; part of animal or plant used, followed by name and natural order of plant or animal.

Habitat (H.).—The country or home where the animal or plant is found. A knowledge of the habitat is of commercial importance, because it enables the buyer to judge of the best time to buy; when new crops may be expected; the prospects of growing crops; influences like drought, war, tariff legislation, epidemics, etc., that may interfere with the gathering of crops or that may affect the prices, etc. Also, to some extent at least, there is more

variation in the appearance of drugs that are gathered in civilized lands than in those from less civilized countries where the natives adhere more blindly to custom; for instance, calumba from Mozambique is invariably in transverse slices, while veratrum viride from North Carolina may be whole, in transverse slices, longitudinal halves or longitudinal quarters, with rootlets or without rootlets.

Description (D.).—This is pharmacognosy proper, and when we examine an unknown drug in order to determine its identity, this is all we can study about the drug until we have fixed its identity. A knowledge of the physical characters of a drug enables us also to judge of its quality. We consider these characteristics in the following order:—

SHAPE, SIZE AND COLOR are self-explanatory words; we must note both external and internal color.

FRACTURE refers to the characteristics that are observed on breaking a piece of the drug. The following kinds of fracture are the more important ones:—

Waxy.—A peculiar granular appearance of the broken surface, as seen on breaking a piece of yellow bees-wax.

Resinous.—Smooth, glossy surfaces, as seen on breaking a piece of rosin.

Conchoidal.—Usually smooth and shining like the resinous fracture, but the surfaces are peculiarly curved, one surface being concave like the inside of a clam-shell, while the other is correspondingly convex. Observed in aloës, extract of licorice, etc. Conchoidal depressions are also observed in the external bark of some drugs.

Brittle.—The substance readily breaks into fragments, as in kino or catechu.

The foregoing fractures are observed in the amorphous drugs, or drugs without cell-structure, while the following occur in vegetable drugs with cell-structure.

Abrupt or Smooth.—Breaking with a smooth surface, abruptly across the drug, as in curcuma, dandelion, podophyllum, etc. This fracture is due to a preponderance of parenchyma tissue, with little or no prosenchyma, or with only soft-walled prosenchyma.

Mealy.—Like the last, with the additional feature that the surface appears to be covered with a fine powder, (starch); seen in

mealy sarsaparillas, Florentine orris, calumba, aletris, ginseng, etc.

Tough.—Breaking with difficulty, or even not breaking at all, except after much twisting and tearing, although readily bending; as in mezereon, cotton root bark, simaruba, etc.

Spongy or corky.—A characteristic of vegetable drugs which have large intercellular spaces in the fresh state, as in calamus, blue flag, etc. There is a peculiar feeling as if the side towards which the piece is being bent is compressed while the other side stretches before the break occurs, which latter, however, is usually abrupt, the feeling of elasticity referred to being the feature that gives the name to this kind of fracture.

Splintery.—The piece of drug breaks into two large pieces on being broken, but a number of small pieces or "splinters" are usually also produced, which fall away. The fracture therefore approaches the brittle fracture of amorphous substances. Apt to occur in cinchona and other barks.

Fibrous.—The broken ends have a jagged or rough appearance from projecting fibers, fibrovascular bundles or wood-cells in whole rhizomes or roots, etc.; bundles of bast-cells in cinchona, etc. The fibrous fracture is a characteristic of a preponderance of hard-walled prosenchyma tissue.

Hazel-switch.—The drug breaks partly through, then splits up and down along the length of the piece, while the remaining unbroken part bends. Seen in gillenia, etc.

These fractures throw much light on the—

STRUCTURE, which, however, is to be ascertained more fully by making sections and examining with a lens or microscope. Usually one examination of the transverse section suffices, but if the student wishes to become qualified to examine powdered drugs, he must familiarize himself with all the cellular elements in the drug. A sample of powdered drug, *known to be pure*, should also be examined, and, if possible, permanently mounted for future reference, although the study of powdered drugs is not, strictly speaking, part of pharmacognosy.

ODOR and TASTE are organoleptic properties which cannot be described in words, except by reference to similar odors or tastes presumably familiar to the reader. We say a drug has a sweet, bitter, aromatic, acrid, mucilaginous or other taste, or that it has a camphoraceous, terebinthinate or other odor, and the words con-

vey an idea because we have experienced such tastes and smells; but there are many tastes and odors which we cannot describe in words and to which we can only refer as "peculiar," as in anise, fennel, peppermint, etc. Such tastes and odors, when once experienced, are usually characteristic and not readily forgotten and often serve as good means of identification of the drug.

Constituents (C.).—Under this heading we list the chemical constituents of the drug; the dispensatories may be consulted for details, but in this book only the most important or active constituents will be mentioned.

An extended study of the active principles of drugs, or descriptions of methods of assay belong to works on pharmacy or of chemistry, but not to works on pharmacognosy. We can, therefore, treat this part of the description of drugs in a quite superficial manner.

It may be of help, however, to say a few words about the "active principles" found in drugs.

Some of the most important active principles are—

ALKALOIDS.—Carbon compounds containing nitrogen and capable of combining with acids to form salts—such as atropine, quinine, cocaine, strychnine, etc. They are usually combined in the drug with some organic acid peculiar to the drug, as meconic acid in opium, quinic acid in cinchona; many are combined with tannic acid, which is found in many plants.

NEUTRAL PRINCIPLES have neutral reactions; they are usually divided into BITTER PRINCIPLES, OR EXTRACTIVES, and GLUCOSIDES.

GLUCOSIDES, when treated with dilute acids, alkalies, or ferments, break up into glucose (sugar) and some other and often quite active substances. For instance, *amygdalin*, a glucoside contained in the bitter almond, in the presence of the ferment *emulsin* and water breaks up into glucose, volatile oil of bitter almond, and hydrocyanic acid.

VEGETABLE FATS and FIXED OILS are glycerides, mainly olein, stearin and palmitin, or combinations of glycerin with oleic, stearic and palmitic acids. On addition of alkalies they are saponified or form soaps.

VOLATILE OILS consist of hydrocarbons of the aromatic series, usually associated with oxygen derivatives, alcohols, aldehydes, compound ethers, acids, ketones and phenols. Some of them exist

in the drugs and are stored in special containers, as in *glands,* in the leaf of eucalyptus, the rind of orange, etc., in the oil-tubes of the cremocarps, as oil of anise, coriander, etc., but some do not preëxist in the drugs but are formed by various reactions, as by action of water on the amygdalin and emulsin of the bitter almond, or by the decomposition of sinigrin (potassium myronate) by myrosin and water in black mustard. Exposed to light and air, they become oxidized and are changed to resins.

RESINS are largely composed of organic acid esters, or compound ethers of certain alcohols; some resins have acid properties, others are anhydrides; they exist in the drugs, alone, (as RESINS) or in combination with volatile oils (OLEO-RESINS), or with gums (GUM-RESINS) or with balsamic acids, such as benzoic or cinnamic acids (BALSAMS).

TANNINS are a class of substances of the nature of glucosides; they produce bluish or greenish black solutions with ferric salts. A drug containing much tannin or tannic acid is astringent or styptic. In the drugs, tannic acid is often in combination with the alkaloid or alkaloids of that drug.

Then drugs may contain gums, mucilage, starch, or other comparatively inactive or unimportant principles. In this book we will only mention the important active principles of the drugs, leaving all mention of assaying to the works on pharmacy.

Uses (U.).—The pharmacist must have some knowledge of the *action* of remedies and of the *doses,* because this enables him to prevent accidents in cases of errors in the prescription through ignorance or carelessness of the prescriber.

Special remarks will be made when there are subjects like adulterations, substitutions, poisonous effects, antidotes, etc., to be considered.

In lectures, history of some drugs may be referred to also, but in this book all reference to this subject will be omitted.

We will study each drug according to the following scheme.

TITLE
N.—O.—H.—D.—C.—U.
SPECIAL REMARKS

ANIMAL DRUGS

An animal drug may generally be distinguished from a vegetable drug by the peculiar empyreumatic odor obtained by heating or burning a portion of it, resembling burning horn or hoofs.

CELLULAR ANIMAL DRUGS

GROUP I

WORMS

Hirudo

N. Leech.—**O.** The live aquatic worm *Sanguisuga medicinalis* and *S. officinalis;* class *Vermes;* order *Annalidae.*—**H.** Found all over the world, but the European leech is the only one kept in drug stores. It is now extensively reared in this country.—**D.** Two varieties are generally mentioned, the "gray leech" *(S. med.)* and the "green leech" *(S. offic.),* but there is no practical reason for making a distinction. Leeches vary in length from 5 to 10 centimeters; spindle-shaped, flattened above and below; with about 100 rings which are merely superficial; head-end with 3-rayed serrate-toothed jaws, tail end with a circular sucker; color of back blackish to grayish-green, with 6 longitudinal ferruginous lines, the four outer of which are spotted black. The body of the green leech is yellowish-green with lateral longitudinal black lines, while in the gray the belly is grayish-black, also lined with more or less interrupted black lines.—**U.** Used for local blood-letting; a European leech draws from 15 to 25 c.c. of blood, which quantity may be increased by bathing the bite in warm water after the leeches have dropped off.

GROUP II

INSECTS

Without wings; angular granules.................................**Coccus**
With wings greenish or coppery metallic luster................**Cantharis**
Wings black with transverse yellow bands......................**Mylabris**

Wings black with longitudinal yellow bands.... ....**Canth. Vittata**
Entire insect brownish black...................................**Blatta**

Fig. 1 Fig. 2. Fig. 3. Fig. 4

Coccus

N. Cochineal.—**O.** The dried female of *Coccus Cacti* enclosing the young larvae; *Coccidae;* class *Insecta;* order *Hemiptera.*—**H.** Mexico mainly, but also in Central America and West Indies.—**D.** Angular grains, about 5 mm. long; oval, flat below, convex above, transversely wrinkled; easily pulverizable; grayish-white ("silver grain") to purplish-black ("black grain"); almost odorless; faint or bitterish taste. In Fig. 1 the larger round one shows a grain after having been swelled in water.—**C.** Carminic acid, soluble in water, alcohol, water of ammonia, etc.—**U.** Coloring agent; sometimes used as an anti-spasmodic in whooping cough, etc. Dose: 0.03 to 0.2 gram.

Cantharis

N. Cantharides, Spanish Flies, Blistering Flies.—**O.** The whole insect *Cantharis vesicatoria;* class *Insecta;* order *Coleoptera.*—**H.** Southern Europe.—**D.** Quite uniform in size, about 25 mm. long and 6 mm. wide (See Fig. 2); cylindrical, slightly flattened above and below; when wing cases are closed all external parts are of greenish metallic luster, the Russian variety having a coppery tint; large membranous, brownish wings under the long, slender, shining wing cases; the powder is brownish with fine shining particles, the fragments of the external structures; odor disagreeable; taste acrid.—**C.** Not less than 0.6% of cantharidin, soluble in alcohol, ether, chloroform, fats, fatty oils, etc.—**U.** Externally as a vesicant; internally, stimulant and diuretic. Dose: Tincture, 0.2 to 0.5 c.c., largely diluted.

Cantharis Vittata

N. Potato bug.—**O.** The entire insect *Cantharis Vittata;* class *Insecta;* order *Coleoptera.*—**H.** United States.—**D.** Shape and size similar to those of Spanish flies; the insect is black with two longitudinal yellow stripes on each wing case, one along the middle and one along the inner margin. Is not found in the trade but is a powerful vesicating agent.—**C.** and **U.** like those of Cantharis.

Mylabris

N. Chinese Blistering Flies.—**O.** The entire insect *Mylabris Cichorii;* class *Insecta;* order *Coleoptera.*—**H.** Indigenous in Eastern and Southern Asia, but brought into trade from China.—**D.** (See Fig. 3). Long, cylindrical body, rounded over back, flat below; variable in size, from 15 to 30 mm. long; the black wing cases marked with a spot at their insertion to the thorax, and two broad bands, spot and bands of a yellowish-brown color. Odor, taste, **C.** and **U.** as of cantharis.

In several lots of Chinese blistering flies I have found a large proportion of a short thick beetle figured beside the Mylabris insect; this insect, which is a variety of *scarabaeus*, has a metallic luster and if powdered with the Mylabris would give the powder of the latter the appearance of the powder of true Cantharides. It is an adulteration.

Blatta

N. Cockroach.—**O.** The whole insect *Blatta orientalis;* class *Insecta;* order *Orthoptera.*—**H.** Everywhere in houses, about sinks, etc.—**D.** Too familiar to need much description. (See Fig. 4.) Flattish, about 25 to 40 mm. long; rudimentary wing cases and wings, nearly reaching the tail end in the male but quite short in the female; brownish-black; nauseating odor and taste.—**C.** Active principle not isolated.—**U.** Internally as a diuretic. Dose: 0.3 to 0.5 gram.

A recently introduced article of commerce is **Flies,** dried, and sold as food for birds.

GROUP IV

Ovum

N. Egg, Chicken Egg.—**O.** Egg of *Gallus Bankira,* var. *domestica;* class *Aves;* order *Gallinae.*—**H.** Domesticated everywhere.—**D.** Too familiar to need description. The yolk is used under the title "Vitellum."—**C.** The white of the egg consists of about 85% water, 12% albumen, 2.7% mucus and some saline substances; the yolk is more complex, about 50% water, vitellin about 16%, palmitin, stearin and olein, about 20%, etc.—**U.** Nutritive. In pharmacy the yolk is used in making emulsions; the albumen for clarifying liquids.

The eggs of other domestic fowls, as of ducks or geese, have a more pronounced flavor than those of chickens, but they may be used instead, if necessary.

GROUP IV.

Parts of Animals Wholly or Partly Soluble in Alcohol or Water

Rolls or flat pieces of tough fibrous structure	**Ichthyocolla**
Long, thin, membranous ribbons	**American Isinglass**
Round sacs, hairy on one side, smooth on the other	**Moschus**
Long grayish-brown sacs	**Castoreum**

Ichthyocolla

N. Isinglass; Russian Isinglass; Fishglue.—**O.** The dried swimming bladders or sounds of the sturgeon, *Acipenser Huso,* and other varieties of *Acipenser;* class *Pisces;* order *Sturiones.* — **H.** Rivers of Russia.—**D.** In flat sheets, more rarely in rolls; tough horny appearance, with a grayish pearly or sometimes iridescent luster; whitish or yellowish; translucent; no odor; insipid taste. —**C.** Almost pure gelatin, nearly completely soluble in boiling water or boiling diluted alcohol. Dissolved in twenty-four times its weight of boiling water it forms a jelly on cooling.—**U.** **Jelly** of isinglass is used as a nutriment; in pharmacy it is also used for clarifying liquids and for making court-plaster.

Book or **Leaf Isinglass** is Russian isinglass in single sheets, or each sheet folded once.

Staple Isinglass is Russian isinglass rolled into cylinders.

Scrap Isinglass is the trimmings and small pieces of Russian isinglass.

Cake Isinglass is made by dissolving the scraps of Russian isinglass and drying the jelly in cakes.

Shred Isinglass is made by cutting Russian isinglass into very fine shreds; used by gilders and glass sign painters. Should not be confounded with shred gelatin which looks similar, but the shreds of which are less tough and more transparent.

American Isinglass

American Isinglass is said by some to be the dried intestines of the cod and of other fishes; others say it is the swimming bladders or sounds of hake, rolled between cylinders under great pressure until quite thin, when it is cut into bands. It is in long thin membraneous bands of a tough fibrous structure; nearly transparent; of pale yellowish color; fishy odor; insipid taste. Inferior to Russian isinglass mainly on account of its disagreeable odor.

Pipe or **Purse Isinglass** is an inferior isinglass made by drying the whole sounds of fishes, without splitting them open.

Gelatin in various forms is also sold under the name of "isinglass," but should not be confounded with isinglass.

Mica in sheets, as used in stoves, lamp chimneys, etc., is commonly but erroneously called "isinglass" by the public.

Moschus

N. Musk.—**O.** The dried secretion from the preputial follicles of *Moschus moschiferus;* class *Mammalia;* order *Ruminantia.* The gland containing musk is situated between the navel and prepuce of the male, immediately under the skin, opening by a small hairy orifice a little in front of the prepuce.—**H.** Central Asia.—**D.** (See Fig. 5). Musk comes in sacs about 50 to 60 mm. long; the convex side is covered with an adherent portion of the skin with short, stiff, brownish-yellow or grayish hairs that point to a center at the orifice of the gland; the flat side is membranous, flat and without hairs. Each sac contains from 5 to 8 grams of a peculiar unctuous substance, which constitutes the *Moschus* of the Phar-

macopoeia.—**C.** Its composition is very complex, none of its constituents, however, being in the nature of an "active principle." Its solubility is variable, from 50 to 90 per cent being soluble in water and from 10 to 60 per cent in alcohol.—**U.** Stimulant and antispasmodic; also in perfumery. Dose: 0.5 gram or more.

There are two varieties; the Chinese smaller and round sacs being the better; the Russian is in pear-shaped sacs and has a more offensive odor.

Even in the sacs musk is often adulterated by the introduction of shot or small pieces of lead or gravel; or the sacs are opened and the musk replaced by a mixture of powdered meat, dried blood, musk, etc., the opening being closed again by sewing or gluing. Even entirely artificial sacs have been made from portions of skin and scro-

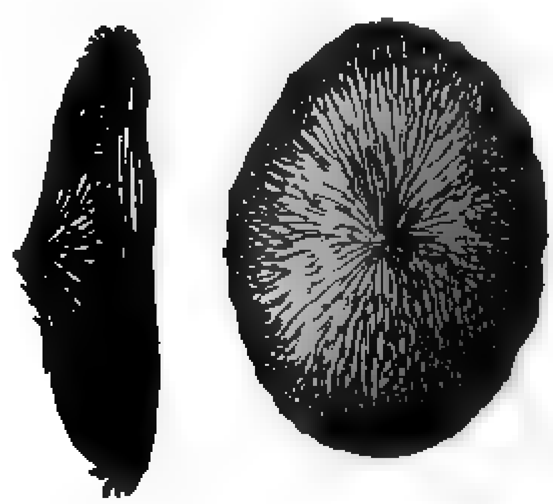


Fig. 5.

tum of the animal and filled with such spurious mixtures. Care will demonstrate the genuineness and integrity of the "musk pods," and musk should not be bought except in genuine and intact sacs, or from reliable dealers.

See also **Moschus**, under Group VI.

Castoreum

N. Castoreum; Castor.—**O.** The glands of the beaver, *Castor fiber*, with their contents; class *Mammalia;* order *Rodentia.*—**H.** Northern parts of both hemispheres.—**D.** In both male and female beavers there are two sacs or glands on each side between the anus and external genitals; the two glands of each pair empty their con-

tents through a common duct, but they are usually unequal in size. In commerce they are usually united in pairs, dark-brown, wrinkled, tough, and when broken have a fatty resinous appearance. Odor peculiar, nauseating and strong, and taste bitter and pungent.—**C.** Volatile oil and resin; not soluble in water, but alcohol dissolves over 50 per cent.—**U.** Stimulant, antispasmodic and antihysteric. Dose: 0.5 gram or more.

There are two varieties; the Russian is in larger sacs and richer in resin and is esteemed more highly than the American which is less odorous, glossier and darker colored.

They may be distinguished from each other by various proper-

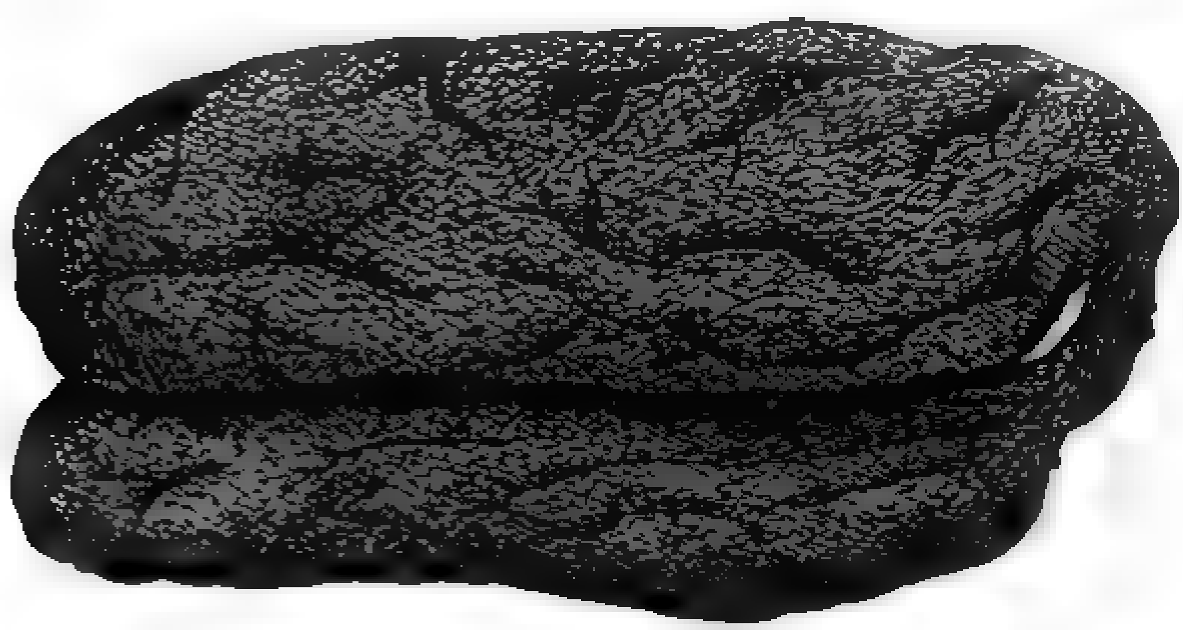


Fig. 6.

ties. Russian castoreum frequently is in single, round or pear-shaped glands, tapering towards the duct; dark brown or almost black on the outside and light-brown within; on fracture it shows a dull surface, never a resinous fracture. The two external membranes can be peeled off easily, one after the other, except in old and hard specimens. The sacs vary in weight from 50 to 250 grams.

American castoreum sacs occur more frequently in pairs. The sacs are smaller, elongated, deeply wrinkled, 30 to 125 grams in weight; break with a resinous fracture, the odor is [illegible] the membranes adhere closely to the contents and cannot be peeled off. The illustration shows the shape of American castoreum.

GROUP V

Parts of Animals Not Soluble in Alcohol or Water

Anastomosing fibers ....Spongia
Flattish, oval, white "bones".................................Os Sepiae

Spongia

N. Sponge.—**O.** The fibrous skeleton of *Spongia officinalis;* Class *Spongiæ;* order *Ceratosa;* family *Spongidæ.*—**H.** The marketed varieties are from the Mediterranean Sea and from the Bahama Islands and the northern coast of Cuba, but they grow all over the tropical and subtropical parts of the world.—**D.** A net work of elastic horny fibers, closely interwoven to form light, porous, flexible masses of various sizes and shapes; yellowish-brown to dark-brown color; peculiar faint odor and no taste.—**C.** Traces of iodine, bromine, phosphorus, .etc., have been detected in sponges.—**U.** Sponge is used mainly for mechanical purposes, for cleansing and washing; or in the form of sponge tents for dilating sinuses, the neck of the womb, etc. "Sponge-grafting," consists in introducing carefully cleansed and sterilized sponge into a deep wound which must heal up by granulations, and has been practiced in cases in which the granulations appeared weak and flabby with a tendency to break down. The meshes of the sponge afford support to the forming granulations, the substance of the sponge being later on absorbed in the same manner in which carbolized catgut ligatures are absorbed. "Burnt sponge," or charcoal made from sponge, was formerly used for the same purposes for which iodine and its preparations are now used; I have had calls for this article under the name "goitre sponge."

There are several varieties of sponges. The best are the Turkey or Levant sponges (from *Euspongia officinalis)* which are soft, velvety, and usually cup-shaped.

Bahama sponges or "horse sponges" (from *Hippospongia equina),* are coarser, although the best varieties, "lamb's wool" and "velvet," are but little inferior to the Turkey sponges.

Sand, gravel and calcareous concretions, corals, shells, etc., must be removed from sponges by beating, washing, or macerating in very dilute hydrochloric acid (1:30). Bleached sponges

are usually injured by the bleaching agents employed, such as chlorinated soda, chlorinated lime, chlorine water or sulphurous acid.

Os Sepiæ

N. Cuttle-fish bone.—**O.** A calcareous body situated under the skin and constituting the internal skeleton of *Sepia officinalis; Mollusca;* class *Cephalopoda;* order *Dibranchiatae.*—**H.** Found washed up on the shores of the Mediterranean Sea.—**D.** (See Fig. 7. Illustration is much reduced in size.) Oblong ovate pieces, 10 to 20 cm. long; 2.5 to 7.5 cm. broad. Convex on both sides, hard and almost porcelain-like on one side, soft and friable on the other; light and porous. White. Odor resembling sea weeds; no taste. On section the friable portion is seen to be made up of numerous

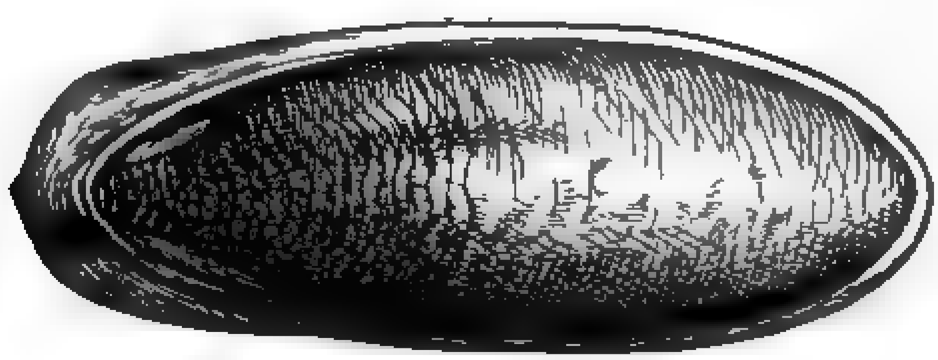


Fig. 7

layers of plates curved in the opposite direction to the hard plate and united to each other by minute spicules or pillars.—**C.** Mainly carbonate of lime.—**U.** Formerly as an antacid; now mainly as an ingredient of dentifrices, and to put in bird cages for birds to whet their bills upon.

Various parts of other animals are sometimes mentioned as drugs.

Bone or **Os.** The solid bones of various domestic animals.

Burnt Bone, or **Os Usta.** Bone burnt in an open fire; in porous, fragile, white pieces retaining the shapes of the bones. Consists mainly of phosphate and carbonate of lime. Used to make phosphorus, phosphoric acid, and solution of phosphates.

Bone Black or **Carbo Animalis.** Animal charcoal is made by

heating bones in closed retorts. Usually found in the trade as powdered animal charcoal. (See Group VI.)

Oyster shells, egg shells, crabs' shells and **crabs' claws, red** and **white coral, rasped harts' horn,** etc., were also formerly used as medicines but are now practically obsolete.

GROUP VI

Solid Non-Cellular Animal Substances

Round, white, calcareous stones	**Lapilli Cancrorum**
Yellow waxy cakes or lumps	**Cera flava**
Thin, round or square cakes, waxy, white	**Cera alba**
White, semi-transparent, unctuous masses of a crystalline, foliaceous texture	**Cetaceum**
Hard, white, somewhat glossy masses	**Acidum Stearicum**
White, solid, fatty masses	**Sevum**
Black, gritty powder	**Carbo Animalis**
Brown, unctuous, very odorous powder	**Moschus**
Cylindrical crystalline masses	**Saccharum Lactis**
Irregular, flat, hard, brown, transparent pieces	**Colla**
Irregular, flat, semi-opaque, yellowish-white pieces	**Colla alba**
Colorless, transparent, rectangular, flexible sheets	**Gelatina**
Opaque, rectangular sheets of frothy texture	**Gelatin**
Clear, colorless, flexible shreds	**Shred Gelatin**
Grayish, brownish or blackish odorous masses	**Ambergris**
Small, hard, tenacious, odorous masses	**Hyraceum**

Lapilli Cancrorum

N. *Calculi Cancrorum, Oculi Cancrorum,* Crabstones, Crabs' Eyes.—**O.** Calcareous concretions found in the stomach, one on each side, of the European crawfish, *Astacus fluviatilis;* class *Crus-*

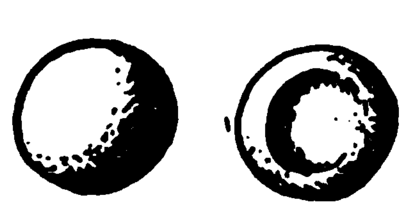


Fig. 8.

tacea; order *Decapoda.* The crawfish are bruised and left in heaps to putrify, after which the remains are washed and the stones picked out.—**H.** Europe, especially European Russia.—**D.** (See Fig. 8.) Hemispherical hard stones, often with a depression on

one side, varying from 3 or 4 to 15 or more millimeters in diameter, or 0.1 to 0.75 gram in weight, grayish-white or reddish-white color, hard or stony consistence and without odor or taste.—**C**. They consist of calcium carbonate and calcium phosphate cemented together with organic matter, in a laminated structure; they effervesce with acids, the calcium salts being dissolved, leaving the animal substance in the shape of the original stones, but soft and flexible.

Spurious crabstones, made from chalk or whiting and glue, and shaped to resemble the genuine, will not retain their shape when treated with acids.—**U**. Antacid. The putting a crabstone under the eyelid to remove a foreign body from the eye is a relic of barbarism and should be discountenanced.

Cera Flava

N. Beeswax, Yellow Beeswax, Yellow Wax.—**O**. Prepared by the bee, *Apis mellifera;* class *Insecta;* order *Hymenoptera.* The honeycomb, after the honey is obtained, is melted in boiling water, in which the impurities either settle or are dissolved; the wax, which floats on top of the water, cools into a solid cake which is then remelted in fresh boiling water, strained, poured into suitable round vessels and allowed to cool. The cakes of wax thus formed are the beeswax of commerce.—**H**. Everywhere in temperate and tropical lands.—**D**. In round flat cakes weighing from one to five or more kilos or in irregular lumps; specific gravity from 0.951 to 0.960 at 25° C.; yellowish or yellowish-brown, brittle when cold, breaking with a peculiar granular or "waxy" fracture; becomes plastic on slightly warming it; it has a sweet honeylike odor and a faint balsamic taste; it is soluble in ether, chloroform, fixed and volatile oils; nearly completely soluble in boiling alcohol; sparingly soluble in cold alcohol and insoluble in water.—**U**. Formerly used internally as a demulcent. Now used only for ointments, cerates, plasters, etc.

ADULTERATIONS.—Insoluble substances, like meal, earth, etc., are detected by melting and straining the wax. If the fracture is resinous instead of waxy, rosin has probably been added and may be dissolved out by cold alcohol, which does not affect wax. Fatty substances, like tallow, suet, etc., cause wax to break with

a smooth, somewhat greasy fracture. Paraffin or ceresin (a native paraffin) is detected by treating wax with ether, and if this dissolves more than fifty per cent paraffin is present; or by heating the suspected acid with fuming Nordhausen sulphuric acid which destroys the wax and allows the paraffin to float on top unchanged. The specific gravity is taken; additions of rosin, stearin or Japan wax make it heavier, while ceresin, paraffin, suet, tallow, spermaceti or lard make it lighter.

Cera Alba

N. White Wax.—**O.** Bleached yellow beeswax. The wax is melted and allowed to fall in thin streams on a revolving cylinder, which is constantly kept wet. The wax congeals in thin ribbon-like strips, which are bleached by exposing to air, sunshine and moisture. An inferior method of bleaching is with chlorine, etc.—**D.** When sufficiently bleached, white wax is melted and formed into thin circular discs of about ten centimeters in diameter, or sometimes into small square cakes. It is white, shining, translucent in thin layers, harder than yellow wax, and without taste or odor. Its specific gravity is from 0.950 to 0.960 at 25° C.—**U.** Same as of yellow wax.

ADULTERATIONS.—Melt a small piece of white wax in boiling water; if white lead or other insoluble matter was added it will sink to the bottom; if starch or flour was added it can be detected by testing the water with iodine for dissolved starch; or a piece of white wax may be dissolved in oil of turpentine or benzin, when the above mentioned substances will sink to the bottom. Chloroform dissolves about twenty-five per cent of white wax; if white wax is treated with eight times its weight of chloroform and more than twenty-five per cent is dissolved, it is impure. Paraffin is detected as in yellow wax. The specific gravity should also be ascertained.

(See Dispensatories for further tests and for descriptions of Japan wax, vegetable wax, ceresin, ozokerite, etc.)

Cetaceum

N. Spermaceti.—**O.** A peculiar, concrete, fatty substance obtained from the spermwhale, *Physéter macrocephalus;* class *Mam-*

malia; order *Cetacea.*—**D.** White, pearly, semitransparent, soft, unctuous masses of a crystalline foliaceous structure; faint odor and no taste; insoluble in water, soluble in ether, chloroform, fixed and volatile oils, etc. Specific gravity 0.935 to 0.944 at 25° C.—**U.** Seldom used internally as a demulcent. Its main use is in ointments and cerates and in laundry work.

Acidum Stearicum

N. Stearic Acid.—**O.** From various solid fats, especially tallow.—**D.** Hard, white, glossy masses without taste or odor.—**U.** An ingredient of glycerin suppositories; otherwise of no use in pharmacy.

Sevum

N. Suet, Mutton Suet.—**O.** The purified internal abdominal fat of the sheep, *Ovis Aries;* class *Mammalia;* order *Ruminantia.* It is purified by melting and straining; should be kept in well closed, glazed or tin vessels, and should not be used after becoming rancid.—**D.** Firm, hard, somewhat brittle, white, fatty masses, without taste or odor. Specific gravity 0.937 to 0.952.—**C.** Stearin, palmitin and olein.—**U.** Emollient in ointments, etc.

Beef Suet or **Tallow** is used for similar purposes; it is softer than mutton suet.

Carbo Animalis

N. Bone-black, Animal Charcoal.—**O.** Bones of domestic animals are subjected to destructive distillation by heating to red heat in closed retorts without access of air. The residue in the retort is animal charcoal.—**D.** Dull black gritty powder, or small lumps, without taste or odor. Insoluble in alcohol or water.—**C.** Charcoal together with phosphate and carbonate of lime. Animal charcoal can be distinguished from vegetable charcoal by incineration, when it leaves about eighty-five per cent of ash, while vegetable charcoal leaves only two or three per cent of ash.—**U.** For decolorizing solutions of vegetable principles, such as alkaloids, etc.

Purified Animal Charcoal is not a drug but a preparation. It is made by removing the earthy salts from animal charcoal by dilute hydrochloric acid.

Moschus

N. Musk.—**O.** It comes into the trade in the sacs, glands, or "pods" already described in Group IV. The Pharmacopoeia recognizes only the contents of these glands, and the retail druggist probably rarely buys musk in pods, but buys the official drug which is described as "the dried secretion from the preputial follicles of *Moschus moschiferus.*"—**D.** Musk occurs in small, irregular, somewhat unctuous, dark reddish-brown granules, which have a bitterish taste and peculiar penetrating and persistent odor. Musk is hygroscopic and contains about ten per cent of moisture; when completely dried it loses its odor, but recovers it on re-absorbing moisture. **C.** and **U.** were described under "**Moschus,**" Group IV, which see.

ADULTERATIONS.—Musk is frequently adulterated, especially in this form; dried blood, muscular tissue, hair, etc., are mixed with genuine musk, and may be detected by the aid of the microscope.

Saccharum Lactis

N. Sugar of Milk.—**O.** From the milk of the cow, *Bos Taurus;* class *Mammalia;* order *Ruminantia.*—**H.** Domesticated.—**D.** The whey left after cheese-making is boiled down, when the sugar crystallizes out; this is then redissolved, decolorized and crystallized on strings or sticks. It usually comes in yellowish-white, hard, cylindrical, crystalline masses, from ten to thirty or more centimeters long, three to five centimeters in diameter. The powder, which is the usual form in which it is kept in the drug stores, is gritty, white, inodorous and but faintly sweetish. Milk sugar is soluble in six times its weight of water at 15° C., and in an equal weight of boiling water; not soluble in alcohol.—**U.** Said to be an active diuretic; has been recommended as an article of diet in certain diseases; but in pharmacy it is mainly used as a diluent in making powders, its grittiness and hardness helping to thoroughly triturate the active ingredients of the powders.

Colla

N. Glue.—**O.** An impure form of gelatin obtained by boiling various animal substances with water; the solution of gelatin so

prepared is evaporated until it forms a jelly on cooling, when the mass is cut into slices which are dried in the air.—**D. Glue** or **Brown Glue** comes into the trade in irregular, hard, flat pieces; sometimes of a somewhat horny consistence. It breaks with an abrupt, often splintery, fracture; the better grades are brownish or yellowish-brown, and transparent; the poorer grades are darker, often almost brownish-black and opaque. White glue **(Colla Alba)** is in similar pieces, but thinner and often flexible, and usually semi-opaque; it is considered an inferior glue for gluing wood, etc.—**U.** In solution as a "size" before painting or varnishing paper or other porous substances and for gluing wood, etc. It is an ingredient of various cements.

Gelatina

N. Gelatin.—**O.** Made like glue, but from choicer and cleaner materials, tendons, sinews, ligaments, bones, etc., free from putrefaction.—**D.** The solution is thoroughly clarified, allowed to gelatinize, the mass is cut into sheets which are laid on frames covered with knotted nets which leave their impress on the dried sheets of gelatin; the sheets are about twenty to twenty-five centimeters long and 7.5 to 8 centimeters wide, and very thin; they are flexible, perfectly transparent, without odor or taste.—**U.** An ingredient in articles of diet. In pharmacy it is used in making capsules, glycerin suppositories, for coating pills, etc.

Shred Gelatin is sheet gelatin cut into very thin shreds by means of a cutting machine. It may be distinguished from shred isinglass by its transparency and by dissolving in water, while shred isinglass merely swells and becomes opaque in cold water.

Another form of gelatin is sometimes met with in the trade which appears to be made by beating the hot solution into froth, which is then allowed to gelatinize, when it is cut into sheets and dried; the sheets are two or three mm. thick and of a frothy texture, not flexible and not transparent.

Ambergris is found floating in the sea, but is also searched for in the intestines of captured whales; it is a morbid secretion formed in the intestines of the spermwhale; it is described as

occurring in friable, grayish, brownish or blackish masses, sometimes striated or clotted. It has a peculiar odor, but no taste. It is only used in perfumery.

Hyraceum is supposed to be the dried excrement of *Hyrax capensis,* a South African animal of about the size of a rabbit. It is in small, hard, tenaceous masses, resembling castoreum in taste and odor. It is practically obsolete, but was formerly used as an anti-spasmodic in the dose of 0.5 to 1 gram.

Pepsin, Pancreatin, Ingluvin, Fibrin, etc., are preparations and not drugs, therefore they are not considered in pharmacognosy.

GROUP VII

Semi-Solid Amorphous Animal Substances

Soft, white, unctuous fatty substance.............................**Adeps**
Soft, yellowish-white fatty substance.......................**Adeps Lanæ**

Adeps

N. Lard.—**O.** The prepared internal or abdominal fat of the hog *(Sus scrofa;* class *Mammalia;* order *Pachydermata),* purified by washing with water, melting and straining.—**H.** Domesticated.—**D.** White, unctuous, fatty substance, soft enough to require being kept in containers which should be impervious to fats and should be kept well closed; odor peculiar but faint, and free from rancidity; taste, insipid. Specific gravity, about 0.917 at 25° C. Not soluble in water and but very slightly so in alcohol; soluble in ether, benzin, chloroform, etc.—**U.** Mainly as a base for ointments, etc.

Adulterations.—Lard is extensively adulterated with cottonseed oil, for the detection of which the official tests should be made. It should also be tested for alkalies, starch and salt (chlorides), and it should be rejected for pharmaceutical uses if it has become rancid.

Adeps Lanæ

N. Lanolin, Anhydrous Wool-Fat, Wool-Fat.—**O.** The purified fat of the wool of sheep *(Ovis Aries;* class *Mammalia;* order *Rumi-*

nantia), free from water.—**H.** Domesticated.—**D.** Yellowish-white or nearly white, tenacious, ointment-like substance, having only a faint odor; insoluble in water but can be mixed with twice its weight of water without losing its ointment-like consistence. Pure wool-fat is more tenacious than the hydrous article of the Pharmacopoeia.—**C.** A mixture of ethers of cholesterin with the ordinary constituents of fat.—**U.** It is claimed that wool-fat is more readily absorbed by the skin than other fats for which reason it is popular as an ointment base. It is also employed for softening the skin and rendering it smooth, as in cosmetic preparations for removing wrinkles from the face and neck, or for improving the form and increasing the plumpness of women's bosoms, etc.

Adeps Lanæ Hydrosus is **Adeps Lanæ** combined with not less than 25 and not more than 30 per cent of water; this is the form in which wool-fat is most generally employed in pharmacy. It is softer and less tenacious than the anhydrous wool-fat, and therefore makes a smoother ointment.

Civet is a semi-solid, unctuous, yellowish or brownish substance obtained from a pouch situated between the external genitals and the anus of the Civet cat of Africa, or of East India. It is obtained from animals confined for the purpose. It is often put up in horns. It possesses an odor resembling that of musk and is used in perfumery for similar purposes as musk, but is obsolete as a remedy.

Butter is sometimes enumerated among animal drugs.

GROUP VIII

Liquid Amorphous Animal Substances

Syrupy, sweet, aromatic, sometimes granular liquid	**Mel**
Viscid, greenish-brown liquid	**Fel Bovis**
Yellowish to brownish fixed oil with fishy odor	**Oleum Morrhuæ**
Pale yellowish or colorless fixed oil	**Oleum Adipis**
Pale yellow to yellowish-brown oil	**Oleum Bubulum**

Mel

N. Honey.—**O.** A saccharine fluid prepared by the honey-bee, *Apis mellifera;* class *Insecta;* order *Hymenoptera.*—**H.** Temperate

and tropical countries.—**D.** "Virgin honey" is a light-colored pale yellow, syrupy liquid, obtained by merely draining the honey-comb; "Clarified honey" is darker colored and is obtained by pressing the honey-comb, or by melting it and then expressing. Honey varies from a thin syrupy fluid to a lard-like consistence, and in color from a pale yellow to a yellowish-brown; its taste and odor depend largely on the flowers from which it was gathered by the bees, but it always has a peculiar aromatic odor and a sweet, peculiar flavor that sometimes leaves an acrid after-taste. On keeping for some time the sugar which it contains becomes granular.—**C.** It is practically a solution of glucose in water flavored with the flavor of flowers modified and added to by the flavor of the gastric juice of the bee.—**U.** As a flavoring agent. Its use in mouth-washes should be discouraged, and glycerin be used instead, as the latter is antiseptic, while honey favors the fermentations on which some of the diseases of the mouth depend.

Fel Bovis

N. Oxgall; Ox-Bile.—**O.** The fresh bile of beeves; *Bos Taurus;* class *Mammalia;* order *Ruminantia.*—**D.** When bought from the butcher it is contained in the gall-bladder; it is a greenish or greenish-brown viscid liquid, having a peculiar, unpleasant odor and an intensely bitter taste. Neutral or faintly alkaline.—**U.** In medicine only the purified oxgall is employed as a tonic and laxative, supposed to be beneficial in cases with deficient secretion of bile. The dose of purified oxgall is about 0.5 gram.

Oleum Morrhuæ

N. Oleum Jecoris Aselli; Cod Liver Oil.—**O.** A fixed oil obtained from the livers of the cod fish; *Gadus Morrhua,* and other varieties of *Gadus;* class *Pisces;* order *Teleostia.*—**H.** Seas of Northern Europe and America.—**D.** There are three kinds of cod-liver oil, differing according to the mode of preparation; white or pale yellow, yellowish-brown and dark-brown. The pale yellow oil is the kind demanded by the Pharmacopoeia, as it is made from the freshest livers, while the dark-brown is made from partially decomposed livers. The taste and odor are characteristic, and are the best criterions for recognizing as well as judging of the qual-

ity of the oil. An oil that deposits a large quantity of solid granular fat at about 0° C. (freezing point) is of inferior quality; the best cod liver oil congeals at a considerably lower temperature. Specific gravity about 0.918 to 0.922 at 25° C.—**U.** As a nutritive; it is supposed also to possess some alterative properties. Dose: Tablespoonful three times a day.

ADULTERATIONS.—Cod liver oil is sometimes adulterated, and the official tests should be applied to determine its purity.

Oleum Adipis

N. Lard Oil.—**O.** A fixed oil expressed from lard at a low temperature.—**D.** A colorless or pale yellow, oily liquid, having a peculiar odor and a bland taste; it has a specific gravity of 0.905 to 0.915 at 25° C. At the freezing temperature (0° C.) it congeals to a semi-solid white mass resembling lard in appearance. It is used in making the ointment of mercuric nitrate.

Neat's-Foot Oil *(Oleum bubulum)* is obtained by boiling the fatty tissue of cattle with water and skimming off and straining the oil. Pale yellow oil with little or no odor or taste. At freezing temperature (0° C.) it becomes opaque. Its specific gravity is about 0.916. Not used in pharmacy.

Blood, Milk, White of Egg, and **Yolk of Egg** are sometimes described as drugs; the latter is always taken from fresh eggs and is described in Group III.

Glycerin, Lactic Acid, Koumys, Kefir, etc., are preparations and not drugs and therefore are not described in pharmacognosy.

VEGETABLE DRUGS

We come now to the consideration of the more important group of vegetable drugs. To understand these drugs we must study several preliminary branches of knowledge, namely, **Botany,** structural and physiological, including the microscopical structure of plants; and **Microscopy** to the extent at least of being able to make temporary preparations for examinations, and perhaps a few simple permanent mounts.

BOTANY

Botany is of comparatively subordinate interest to the pharmacist and the study of a simple work on the subject, such as *Gray's Lessons in Botany,* will suffice for all practical purposes. There is a tendency in certain quarters to give botany an undue prominence as a study for pharmacists, both as to the time devoted to it, and as to the amount of detail taught.

This exaggeration of the importance of botany at the expense of time that might be more profitably devoted to pharmacognosy, reminds one of the old gentleman who said that the Germans, in speaking English, often put the "*em-pha'-sis*" on the wrong syllable.

The study of botany is no doubt a fascinating one, calculated to give much enjoyment to an enthusiastic student, but it should be taught in colleges of pharmacy with direct reference to the needs of the pharmacist, aiming merely to make him a good pharmacognosist and with no aim to make the druggist an accomplished and thorough botanist. If a student likes the study and wishes to perfect himself in it, he should do so under no mistaken idea that it is essential to his becoming either a good pharmacist or a good pharmacognosist; this being kept in mind the student may devote as much time and study to botany as he pleases, but the essentials, as taught in the book referred to, are sufficient for practical pharmaceutical purposes.

From the book mentioned above a student can learn to know the different parts of plants when he sees them, which is practically all that he needs of structural botany now. The general facts in regard to the structure of plants will be studied a little farther on, and the details particularly relating to the different parts of plants forming separate groups of drugs will be considered when describing those groups. Recognizing the minor value of a botanical classification of drugs, no stress is placed on this subject because it is of little or no practical use to the pharmacognosist or pharmacist. Systematic modern pharmacognosy being based to a great extent on a knowledge of the microscopical structure of plants we must study this branch of knowledge rather thoroughly, and as a preliminary study we must devote a little time to a consideration of microscopy.

MICROSCOPY

This study should include not only the study of the microscopical structure of drugs, which is also taught in the lectures on pharmacognosy, but also the technology of the microscope; commencing with a study of the principles of optics it leads the student to a knowledge of the structure and uses of the microscope and its accessories; it explains all the methods of preparing both temporary and permanent vegetable histological specimens; it teaches all methods of cutting, bleaching and staining sections, and all methods of mounting them, dry and in all the different media that are employed; all methods of measuring, drawing and photographing microscopical preparations, for book illustration or lantern slides; and in fact gives such a knowledge of all matters pertaining to the microscope that the student becomes able to intelligently judge of the value of any microscope he may wish to buy and fitted to use the instrument for any branch of science whatever.

In this Handbook we cannot dwell so extensively on the use of the microscope but must content ourselves with the general principles and simplest manipulations only. The student of this book who is not a student attending college, where the necessary microscopes are provided for use in the laboratory, need not imagine that it is necessary to spend much money to follow the instruction; in fact, a Coddington lens magnifying about ten diameters, or a quite simple and cheap "dissecting microscope," will be sufficient for most of the work to be described, and the cost need not exceed a few dollars. With even such simple appliances the earnest student can follow the notes and examine the structure of drugs and become quite an expert pharmacognosist, but if money is no object a good compound microscope may be bought and the investment will amply pay in knowledge and in pleasure.

A Luminous Body is one that emits light, such as the sun, stars, lamps, electric lights, etc. All our sources of artificial light are incandescent, or glowing from heat. Light is a wave-motion in the "ether" of space which permeates our atmosphere as well; it is emitted in every direction by a luminous body, and an undulation or wave of light once started proceeds in an absolutely straight

line as long as it traverses a substance of the same density, as for instance, celestial space.

A "ray of light" is an imaginary isolated wave or undulation going in a given straight direction and of practically no width or thickness; really a "ray of light" does not exist, because light is not a substance but merely a motion.

Transparent Bodies or Substances permit rays of light or light-waves to pass through them, so that we can see the form of objects beyond (as for example: air, water, glass, etc.); sometimes, however, a transparent body may intercept some waves of light, permitting only a portion of certain wave-length to pass through, the effect being that the transparent body appears not colorless but colored (as for example: red, blue, green or yellow glass, etc.).

Opalescent, Translucent or Diaphanous substances permit light to pass through more or less perfectly, but their structure interferes with the course of the light waves, so that the form of an object cannot be seen through them (as for example: ground glass, white wax, etc.). This is due to irregular and interfering reflections and refractions which may take place on account of surface roughness, as in ground glass, or to the inner arrangement of the texture of the substance, as in tissue paper or white wax.

Many translucent or semi-opaque substances may be made clearer or even transparent by filling the interstices in their texture with a substance having a refractive power similar to that of their fibers or particles, or by covering their surfaces with a varnish.

A few simple experiments will prove instructive. Powder some clear glass and put it into a test-tube; it will appear as an opaque white powder; pour on it some turpentine and it becomes transparent. Drop a little balsam of fir on the rough surface of ground glass and press on it a piece of clear transparent glass; the ground glass becomes transparent by the abolition of irregular surface refractions and reflections. Take white tissue paper and fill its pores with olive or castor oil; it becomes translucent by the abolition of interfering refractions and reflections within its textures or fibers; or compare ordinary tissue paper with paraffin paper, in which latter the interfibrous spaces have been filled with paraffin.

Opaque Bodies permit no light to pass through them.

Opaqueness is often only relative; a single sheet of white paper

is translucent, but a dozen or a hundred sheets together will probably be as opaque as a brick wall. A gold coin is opaque; moisten a piece of glass and attach a bit of gold-leaf and by holding it up to the light the gold will be found to transmit a greenish, bluish or purplish light, the color depending on the thinness of the gold-leaf. That the gold itself is transparent in thin enough sheets is proved by examining the film with a microscope or lens; any holes in the leaf will transmit white light, while the greenish or bluish light passes through the gold where the microscope shows no break of continuity.

It is not ncessary here to enter at length into a consideration of the structure of the microscope. A simple microscope is a single lens, or an achromatic combination of lenses acting as a single lens. Such lenses are of low power but will enable the student to do a great deal of really good work and to acquire much valuable information. A Coddington lens, or a so-called linen-tester, should be obtained. Still better, because more convenient, is a "dissecting microscope" of the simplest kind, because this is provided with an upright rod for supporting the lens, leaving both hands free for manipulating the specimen or slide which is being examined. For the more thorough examination of the mounted specimen a compound miscrope may be employed.

A few dozen slides (glasses three by one inches in size), and half an ounce of cover glasses of about five-eighths inches diameter may be purchased from the optician.

If we wish to examine a drug in a hurry, with no intention of keeping the specimen, we require little more apparatus. If it is a powder, as for instance lupulin, kamala, lycopodium, or any other powdered drug, a little of the powder is moistened with a drop of water or glycerin, and placed on a slide. A cover glass is then carefully dropped on it, first lowering one edge and then dropping the cover glass so that the air is driven out but not with enough force to drive out the liquid and the specimen. A little practice will enable one to judge how much liquid to take. Such a preparation requires a rather high power, however, and cannot satisfactorily be examined unless one has a compound microscope. If water or glycerin does not make the object transparent, we may have to treat it as we did the tissue paper in our little preliminary experiment; we use turpentine or some volatile oil, such as oil of

cloves, or oil of cedar, to make the drug more transparent; if that will not make it clear, we take a drop of solution of potassium hydroxide or of labarraque solution instead of water or glycerin, each time taking a bit of fresh material, of course. This will dissolve the cell contents and render the cell transparent, but the specimen will soon swell and be spoiled. This method will therefore answer only for temporary and immediate examination. A little soaking in alcohol is often of use in removing too dense color.

Seeds, surfaces of leaves, fruits like anise, fennel, caraway, etc., may be examined without any preparation, and with the single lens. Many objects of great interest and beauty will be found among these drugs. Roots, rhizomes, barks, etc., should be cut with a sharp knife so as to present a smooth surface; the section is sometimes much smoother if the drug is previously soaked in water. This surface may be examined without further preparation, but usually more detail can be seen by putting a drop of glycerin on the smooth surface, dropping a cover glass on it, and then examining. Some drugs of this kind, however, will not show much detail and sections must be prepared. The drug is soaked in water to soften it, and then a thin transverse slice is cut from it with a sharp knife or razor. A little practice will enable the student to cut fairly good sections in this way, but for making first-class mounts a mechanical device known as a microtome must be used, so that the sections may be of uniform thickness throughout. Sections should be cut as thin as possible.

Such a section may then be laid in a drop of water, glycerin or alcohol on a slide and covered with a cover glass; it is then ready for examination. If it is not clear enough it may be soaked for a few moments in solution of potassium hydroxide, then gently washed in water with a camel hair pencil, and examined as just suggested. Or the freshly cut section may be dropped into alcohol, then changed to absolute alcohol, then into oil of cloves, and then transferred to a slide, on which a drop of oil of cloves has been placed, covered with a cover glass and examined.

Watch glasses or the lids of small glass or porcelain ointment jars are good receptacles in which to do any soaking of sections that may be necessary.

If the slide is to be examined with a microscope, care must be

taken to wipe away any surplus liquor that may be pressed out from under the cover glass, to avoid soiling the instrument. After the specimen has been examined it may be washed off in water, or in a little alcohol if necessary, and the glasses rubbed dry with a bit of tissue paper.

But if we wish to preserve the specimen for future study, a permanent mount must be made. The same kind of glass slides, three by one inches, is used, but it would be well to have an assortment of sizes of cover glasses, some of one-half, five-eighths and three-fourth inches in diameter. A few dozen small brass curtain rings, five-eighths inch outside diameter, should also be obtained.

The appliances required for making permanent mounts are few and inexpensive; the student should procure a few camel hair pencils; a few watch glasses or one-half ounce or one ounce white porcelain ointment jars with covers, a delicate pair of scissors; one or two small knives similar to the smallest knives in a student's dissecting case; a few needles, the eye ends of which have been pushed into the ends of small wooden handles, for which cheap pen holders will answer very well.

A few spring clips for holding on the cover glasses may be bought from the optician. A few one-ounce vials are provided with perforated corks in which ordinary pipette medicine droppers are inserted so that the end of the pipette will reach nearly to the bottom of the vial.

A few small bell glasses to cover slides which are in process of preparation and protect them from dust may also be used, but placing such slides in the bottom of empty cigar boxes and closing the lid is just as good.

In one of the vials with pipettes we put glycerin; in another creosote water; in a third a mixture of glycerin and water; and we add a few ordinary vials, one containing alcohol, one absolute alcohol and one oil of cloves.

Evaporate a few ounces of clear, clean Canada balsam until it is thick and nearly solid on cooling. Pour one-half ounce of this thick balsam, while warm, into a vial and add one-half fluid ounce of chloroform; leave the balance of the balsam in its thick condition; or balsam already prepared and put up in tubes can be bought. Set all these vials in a closet or deep cigar box where they are protected from dust.

Buy a small vial of each, Brunswick black, zinc-white, and picro-carmine.

If economy does not forbid, a section cutter and a self-centering turn-table may be added, but the latter are not necessary for serviceable work, but they add much to the mechanical perfection of the finished slides.

There are practically three methods of mounting slides; dry, in a solid medium, or in fluids.

We will first consider dry mounts. Of many drugs we need simply examine the surfaces, for instance, when comparing digitalis leaves with mullein leaves which are said to be occasionally added or substituted for the first; or in examining seeds and fruits like anise, conium, etc.

First: Prepare the slide by pasting in the center a disc of black needle paper, or of white paper, made by punching with a punch such as is used for making gun-wads or a cork borer; then punch similar discs from different thicknesses of paper, cardboard and thin pasteboard. In these discs punch holes one-half inch in diameter with a smaller punch, so that when completed we have rings of different thicknesses. When we want to make a dry mount we paste one of these rings on the paper disc on the slide, choosing black or white as it looks best for a particular object, so that we have a cell with a white or black bottom, and of a depth which is slightly greater than the thickness of the object to be mounted. A bit of the leaf, preferably cut with a cork borer on a piece of leather into a disc a little less than one-half inch in diameter, is then fastened to the bottom of the cell by means of a little schellac varnish or tragacanth paste and pressed flat by gently pressing into place with a cork having about the same diameter as the object. Clean a cover glass three-fourths inch in diameter by gently rubbing between two pieces of moist filtering paper between the thumb and index finger, then in the same manner with a soft, well-worn silk handkerchief and after rendering the upper side of the paper ring adhesive with shellac varnish or tragacanth paste put on the cover glass. Finally punch a hole one-half inch in diameter from a strip of colored glazed paper and paste it over the upper surface of the slide so that the opening in the strip corresponds to the cell in which the preparation is mounted; the edges of the paper must then be cut with scissors along the edges

of the slide and when dry a label may be pasted on one end of the slide on which the name of the object is written.

Seeds and other dry opaque objects may be mounted in the same way, care being taken that the cover glass is as near as possible to the upper surface of the object without actually touching it, and that the prepared cell and the object itself is thoroughly dry before the cover glass is put in place.

Second: Paint a circle five-eighths inch in diameter on the slide with Brunswick black or with zinc-white, according to whether the object looks best on a dark or white background. Place one of the curtain rings on this painted circle and allow it to dry. The bottom and sides of the cell thus formed must then be painted with the same cement and allowed to harden. Cells of this kind should be prepared some days or even weeks in advance, so that they are thoroughly seasoned when wanted for use. The well-dried object to be mounted is to be fastened to the bottom of the cell by a little of the same cement of which the cell is made, and allowed to harden in place, always protecting the cells against dust in all stages of preparation. Finally paint a thin circle of the same cement on the upper edge of the curtain ring and place a clean, dry cover glass five-eighths inch in diameter on the ring. When fast, the outside of the cell is painted with the same cement so that it overlays the glass cover, and if this work was all done on the self-centering turn-table, ornamental colored rings may be put on as a finishing touch.

If the zinc-white cement becomes too thick to flow readily, thin by adding a little benzole. Use the brush well filled with cement when putting in the bottom of the cell, so that when the cement dries it will be perfectly smooth like fine white porcelain. Instead of making dark cells with Brunswick black, the bottom of a zinc-white cell may be painted black with ivory black such as is put up in collapsible tubes for artist's use. Such cells are harder and there is no danger of the cement softening in warm weather and allowing the objects to sink into it as sometimes occurs when we use Brunswick black.

We come now to the consideration of balsam mounts but as this method is used mainly for sections of drugs we will first consider the making of the sections. The first requisite is that the section be cut thin enough; if possible, not more than one cell

thickness of the substance to be examined or from $\frac{1}{10}$ to $\frac{1}{8}$ millimeter thick. Practically, cut as thin as possible without tearing the sections. The knife should be very sharp and should be carried across the drug with one steady sweep and not by cutting backward and forward. Some drugs can be cut without preparation, but the majority of drugs require previous softening in water over night, or if very resinous they may be soaked in alcohol to remove the resin and then in water to soften them. Woods and woody roots, rhizomes, hard barks, etc., may sometimes require boiling in water to make them soft and flexible enough to give good sections. If the sections are to be cut without a microtome or section cutter, the substance is held in the left hand and the sections are cut by drawing the knife towards oneself, much in the manner in which lead pencils are sharpened. A little practice will enable one to do good work, although, of course, the serviceable portions of the sections may be smaller than when cut by aid of a section cutter.

If the student works with a section cutter in which an extra tube moves up and down in a well-tube, the object is wedged in this tube with cork or elder pith, or if it is hard like wood, by simply forcing a piece of it into the tube so that the end projects about one centimeter. This tube, with the object to be cut into sections, is then placed in the section cutter and gradually raised by means of the screw until the knife carried over the top plate of the apparatus cuts off a portion of the object and leaves it with a smooth surface. While cutting, the surface of the object and the knife should be kept thoroughly wet to prevent tearing the sections. By means of the screw the object is raised a trifle and a section cut off with one steady sweep of the knife; if it tears, try a little thicker section, until the proper thickness has been ascertained, when the balance of the sections are cut of that thickness. Of course the knife must be sharp and without notches on its cutting edge, and the proper thickness of section for each object is the thinnest that can be cut without tearing. When cut, the section is carefully floated off into a watch glass or small procelain saucer by means of a small quill camel hair pencil. Section after section may be cut until the object no longer projects above the inner tube, and if we were at all care-

ful we ought to have at least thirty or forty sections from the portion of object that protruded.

Another method of cutting sections which is better adapted to soft or small objects, is to imbed them in paraffin; make a paper tube of the thickness of the inner tube of the section cutter, fit a cork in the end of this tube and then fix the object to be cut (which must first be properly softened by soaking in water, if necessary) to the cork in such a manner that it will stand upright in the tube when the cork is inserted in one end of it; then pour in melted paraffin, which, when it cools, will form a plug of paraffin in which the object is imbedded. This plug is then fastened in the section cutter and sections are cut from it in the same manner as just described. These sections are then placed in benzene or chloroform to dissolve the paraffin, the sections are then removed to alcohol and from that they may be transferred to such other mounting media as may be desired.

We examine these sections with a lens, choose one of the thinnest and most perfect ones and mount it permanently in glycerin or glycerin jelly, as will be explained presently, so that we may study the cell contents, starch, etc.

The sections of many drugs, however, are unsatisfactory when examined and mounted in this way and we must first clear them; the simplest way being to place a section in a watch glass with distilled water and then wash it gently by stippling with a camel [illegible] of the cell contents may [illegible] washing sufficiently clears them. [illegible] we must clear them with [illegible] cell-contents, which, by the [illegible] examination of most of [illegible]

[illegible] six to eight [illegible] thirty drops of [illegible] this mix- [illegible] and [illegible] [illegible] section is [illegible] that [illegible] and [illegible]

their shape, but will not wash out and the result will be disappointing. Allow the sections to remain in this solution, from a few hours to a few days, as may be necessary; an occasional examination will show when the sections are clear, when this solution should be poured off and replaced by two or three changes of distilled water, and when sufficiently washed, by a twenty or twenty-five per cent mixture of alcohol with water, in which the sections can then be preserved for years until wanted for permanent mounting.

Some prefer to use undiluted labarraque solution instead of the above diluted solution, but it requires more careful watching, and even in spite of this, many delicate sections go to pieces and are ruined; of course the undiluted solution may clear and bleach a section in a few minutes, but it is usually safer and better to "make haste slowly," and the method recommended will give excellent results.

Immersing the sections in chlorine water will also sometimes give excellent results; when sufficiently bleached, wash in several changes of distilled water and preserve in diluted alcohol of about twenty-five per cent strength.

Still another method of clearing sections or powdered drugs, is to macerate in a concentrated solution of hydrated chloral in water.

One of these cleared sections may be stained by placing it in a watch glass or small porcelain dish and covering it with a few drops of picro-carmine, which stains sclerenchyma or stone cells yellow and cellulose cell walls red. After ten or fifteen minutes we may drain off the picro-carmine and pour on a few drops of alcohol (commercial ninety-five per cent) and gently wash out the excess of staining fluid with a soft camel-hair brush; then transfer to another watch glass and cover with a little alcohol, drain off the alcohol and add a little *absolute* alcohol to remove all water from the section and finally transfer carefully from the absolute alcohol to a little vial containing oil of cloves, in which the section may remain until it is to be permanently mounted. Of course we may as well take a number of different sections and treat them together as there will usually be little or no difficulty to correctly label them, as we can compare with the sections preserved in the diluted alcohol, but if the sections closely resemble

each other we must keep them separated unless we are quite familiar with their appearance.

In giving elementary instructions for the preparation of mounts, such as are intended to be here given, it is unnecessary to dwell on the different methods of staining for the differentiation of different tissues. Information on this subject must be obtained from some special work on vegetable histology.

When we have accumulated a number of sections in oil of cloves or oil of cedar we are ready to mount them in Canada balsam. For this purpose it is well to have a warm table, which can be cheaply made by a tinsmith in the shape of a tin box about ten inches square on top and from four to six inches deep; a screw-cap is soldered in one corner to allow water to be poured in, and near it a circular cup-shaped depression which will hold the bottle in which we keep the hardened Canada balsam. When the box is filled with hot water and the screw-cap is fastened down, the apparatus should be water-tight. This box may be fitted into a wooden tray for convenience of handling and to avoid too rapid radiation of heat from the box. When filled with hot water the top of the box becomes a hot table which will not become overheated and which will retain sufficient heat to allow us to work for several hours before it becomes too cool.

When we wish to mount sections in balsam, we first clean a few more glass slides and cover glasses than we will probably require, to make allowance for accidental soiling. The tin box is then filled with water having a temperature of 65° to 80° C. (150° to 175° F.), the screw-cap fastened down and the bottle with hard balsam placed in the cup-shaped depression or well. When the balsam is melted a few slide glasses are laid on the warm surface of tin and a little of the balsam is then placed in the center of each slide by means of a small syringe or a glass rod, care being taken that no air bubbles are inclosed in the balsam. We next take a small forceps and taking a section from the oil of cloves, we thrust it deep into the liquid balsam on a slide. The adhering oil of cloves will remain on the top of the balsam. We then take another forceps and lifting a cover glass by its edge warm it slightly over a lamp and hold it over the drop of balsam on the slide. We take the straight needle in its holder in our left hand and hold it at the left margin of the balsam drop, or

a little to the left of the section in the center, if the balsam has spread too far. The lower edge of the cover glass is then steadied against the needle-point and the cover is allowed to slowly sink down on the balsam, driving before it all the oil of cloves and some of the superfluous balsam. If we are not careful to push the section to the bottom of the balsam on the slide, the section may occasionally be carried out with the superfluous balsam, but if it shows a tendency to do so, we can usually manipulate the cover glass to prevent it or use one of the needles to hold the object under the cover glass. We may also occasionally require the needles to tease out any air-bubbles that may accidentally be held under the covers, but a little practice will enable one to judge pretty accurately how much balsam to put on the slide and how to manipulate to avoid air-bubbles.

By a little more or less pressure on one side or the other of the cover glass the section can be correctly centered and a spring clip may be applied to press the cover glass down firmly as well as to make the film of balsam as thin and flat as possible, and then the slide may be laid away on a board to cool.

When the slides are cool and the balsam is sufficiently hardened the superfluous balsam may be carefully removed with a warmed knife, but care must be taken not to get the knife under the edge of the cover glass or the latter may be cracked and the slide spoiled. In such a case the whole slide must be warmed, the pieces of cover glass slipped off to the side and the section, if uninjured, returned to the oil of cloves to be remounted later on in the same way. After most of the balsam has been removed with the knife, the slide is cleaned with a soft toothbrush dipped in alcohol, then with another soft brush with soap and water, finally rinsed in clean water and dried, and then a label is affixed to one end of the slide. Or if a finish is desired, the slide may be put on a turn-table and a ring of shellac varnish (shellac dissolved in alcohol) run around the cover glass, overlapping the edge of the cover glass and a little beyond it on the slide.

Or we may mount our sections in a drop of the solution of the thickened balsam in chloroform or benzol, manipulating as explained above, but without warming. The section taken from the oil of cloves should be rinsed in chloroform or benzol, as the case may be, before placing it in the balsam on the slide, and

when the spring clip is applied the slide must be laid away to harden. It takes a long time for it to do this, and this method of mounting is not recommended, except for very delicate sections.

It has been suggested that a ring of the size of the cover glass be painted on the back of the glass slide on the self-centering turn-table to enable the manipulator to center his object properly when mounting in either balsam or glycerin jelly; when the mount is ready this ring of color is, of course, washed off in cleaning the slide.

For most purposes it is best to mount in one of the fluids already mentioned; but as the mounts in glycerin jelly present nearly all the advantages of the fluid mounts, combined with the simplicity of balsam mounts, we will first consider this method of working before proceeding to the more difficult mounting in cells.

Glycerin jelly may be purchased from the dealer in microscopic sundries. It is practically a jelly made by dissolving gelatin in glycerin with some antiseptic to prevent moulding. The mass is similar to that of the hectograph pad, or to gelatin suppositories, special care being taken to have the materials absolutely clean and free from dirt. It is more satisfactory to buy the small quantity needed, than to attempt to make it.

For mounting in glycerin jelly proceed as for balsam mounts; use the warm table, but at a lower temperature than for balsam, only just enough heat being used to liquefy the jelly, the bottle in which it is contained being placed in the depression in the table. A watch glass with a small quantity of jelly is placed on the table and the sections to be mounted are transferred from the preserving fluids to this glass and immersed in the fluid glycerin jelly, where they are left for a few minutes until they are thoroughly permeated by the mounting medium the watch glass being meanwhile covered to prevent dust from falling into it. Of course, it will be understood that sections or objects preserved in oil of cloves cannot be mounted in this medium, only those in the watery fluids being available; those kept in alcohol may be rinsed in distilled water and then transferred to the jelly. If objects are mounted direct from the preserving fluids it may

prevent the setting or gelatinizing of the medium and the mount may prove a failure.

The mounting is proceeded with exactly as in the case of balsam, using the liquefied jelly instead of the liquefied balsam. The dropper should be filled by emptying of air, then inserting the end in the liquid and filling gently and slowly to avoid air bubbles, and it should never be emptied of its air while the point is immersed in the jelly, as this would blow the jelly into a froth from which it would be almost impossible to remove air-bubbles. After the cover glass is applied the slide is put away to cool, but the spring clips should not exert more pressure than is absolutely necessary to keep the cover in place and the object flat. Upon cooling the glycerin jelly "sets," or becomes solid, and when thoroughly set the slide must be washed in *very cold* water to remove the excess of glycerin jelly outside of the cover glass; it is then rinsed in clean *cold* water, dried with a bit of blotting paper or filter paper and laid away to thoroughly dry, when it is finished by painting the edge of the cover glass with a ring of cement, such as white-zinc cement, Brunswick Black, dammar varnish, or balsam in chloroform. This ring of cement is painted so as to be about one-eighth of an inch wide, overlapping the edge of the cover glass so as to fasten the cover glass to the slide.

For mounting in fluids a turn-table (self-centering preferred) is almost indispensable, and the needles in handles and one or a few cements complete the necessary materials and appliances. Brunswick Black is the most generally useful cement but shellac dissolved in alcohol, decanted after settling, is also good. The cement is kept in a vial stopped with a very fine velvety cork to avoid particles of cork from falling into the vial; in the under end of the cork a small camel hair pencil is inserted, which is left in the cement when not in use, so that it is always soft and ready for use.

The cells should be prepared in advance by painting a circle on a slide; the inside of this circle must be smaller than the cover glass to be used, and the outside must be somewhat larger than the cover glass. The slide is laid away in dust-proof boxes until this cement-ring is thoroughly hardened. If the cell is not deep enough, a second or even third or fourth ring is painted over the

first, allowing each to harden before adding the next. An assortment of such cells should be kept ready for use.

The objects to be mounted should be soaked in the fluid in which they are to be preserved for some time so that they may be thoroughly permeated with the fluid.

When ready to mount the preparation, place a slide with a suitable cell on the turn-table and center it; then paint a ring on the cement cell so that it will not touch the inner margin of the cell at any point. With a shellac cell this ring may be painted with benzole solution of balsam; with a Brunswick Black cell Brunswick Black is used. When this fresh ring becomes "tacky" or sticky, the cell is carefully filled with the fluid (glycerin, creosote, or chloroform water, etc.), and the object is placed as near as possible in the center of the cell; this is done by laying a piece of plate-glass on a black paper or velveteen, and using this as a table upon which to work, because a delicate object is thus best seen. The object is carefully arranged in the cell by aid of the mounted needles; after which a clean cover glass is taken up with a delicate pair of tweezers or forceps in the right hand. A needle is held against the cement cell on the left side, the edge of the cover glass is rested against it and then the cover is allowed slowly to settle down on the cell. By first breathing on the under side of the cover glass, the fluid will more readily come into contact with it, and there will be less liability to imprison air-bubbles in the cell. When the cover glass is in place, press it down gently until it is cemented in place by being in close contact with the sticky cement, which can readily be seen by reflected light. As long as any part of the circle of cement is not in contact with the cover glass, a fault exists which will probably result in destroying the mount. In pressing the cover into contact with the cement, the pressure must not be applied to the center of the cover glass, as this will yield to the pressure, a portion of the fluid will be forced out, and when the pressure is removed an air-bubble is liable to be drawn under the cover glass; then the slide is spoiled and the section must be remounted.

If the cover glass has been successfully brought into place, the slide is laid aside for a little while to allow the cement to become sufficiently hard to permit the slide to be washed under a gentle stream of flowing water from a sponge; then lay aside to

dry. When dry, paint a circle of the same cement over the edge of the cover glass, overlaying the latter and fastening it to the slide. If the glycerin was not *completely* washed away before adding this last ring, the cover glass will finally crack off and the mount will be ruined, while, if the ring of cement painted on the hardened cell was allowed to touch the glass within the cell, the cement will probably run in and eventually replace the fluid and thus also ruin the mount. If care was exercised, the cell so made is practically permanent, although it may be well to paint a thin ring of cement over the outside ring every few years to make sure of the integrity of the cell. I have hundreds of mounts in glycerin, or glycerin and water, which were made over twenty-five years ago and which have never been repainted, but which are perfect in all respects to this day. In the watery mounts fungoid growths sometimes appear, ruining the original slides; but sometimes these slides are very valuable on account of the interesting growths that have obscured the original object. Especially interesting is the study of the conjugation of some of these low forms of vegetable growth, and until we are sure that this adventitious object is valueless we should not be in a hurry to reject the slides as ruined.

The following precautions should be constantly held in mind when mounting in fluids:—

Glycerin, or glycerin and water in equal parts, make the best and most permanent mounts. Pure glycerin in the course of time renders delicate objects very transparent and the glycerin and water is perhaps preferable for that reason. The glycerin protects against fungoid growths.

When putting on the ring of cement just before mounting, be sure that it is not put on the inner third of the cement cell, for when the cover glass drops into place the fresh cement will be drawn by capillary attraction, *to* the inner edge, but not *down* the inner edge. If it touches the glass at the inner edge of the cement cell, the cement may run in and ultimately ruin the slide.

Exert no pressure on the cover glass, except at its margin when putting it in place. Be sure to have enough but yet not too much fluid in the cell, so that the cell may be completely full when the cover glass is in its place; as glass is elastic, pressure on the cover glass, except at its margin, will force out too much fluid

and the strain of the glass to regain its shape will draw in air or cement, to the great injury of the mount.

Finally, *be absolutely sure that all traces of glycerin are washed off from the slide and that the slide is perfectly dry, before putting on the finishing circle of cement;* carelessness in this respect will incur the risk that the cover glass may crack off from the slide Of course, this applies as well to the circles of cement that constitute the cell itself. Even if only a minute crack appears at any point, the water of the mounting fluid will eventually evaporate and the cell become valueless.

Only a few words need be added in regard to objects other than sections of stems, roots, fruits, etc. The epidermis of leaves may be separated by macerating the leaf in water for some days when the epidermis can be peeled or torn off in large shreds,—the epidermis is best mounted in fluids. Powdered drugs are best examined by mounting in water or glycerin, after having been first macerated in dilute alcohol to remove too dense color if this is necessary. Or the powdered drug may be mounted in balsam after treating in the same way as has been described for sections. But powdered drugs should not be treated with Labarraque solution, nor with solution of potassium hydroxide, because these would destroy starch and other characteristic parts of the object to be examined. It is advisable to mount slides of what are *known to be* pure powdered drugs, for comparison with suspected specimens, but the latter must not be considered to be willfully or intentionally adulterated, unless foreign histological elements constitute an appreciable proportion of the specimen, as accidental foreign matter may remain, due to imperfect garbling before grinding. Particles of dust, bits of cotton or jute fibre from the original package, insect or vegetable scales or hair, etc., are often and unavoidably present.

PHOTO-MICROGRAPHY

When a very minute photograph requires a lens for seeing it, it is called a *micro-photograph;* a large photograph made by enlarging a minute object by aid of a microscope, is called a *photo-micrograph.* The difference should be well remembered.

Many writers recommend that drawings of the objects be

made by the aid of the camera lucida, but this is a useless waste of time, as the specimen itself may be reëxamined whenever one wishes to do so. All slides should be kept in trays, *lying flat*, and be protected from frost in winter and from too great heat in summer. If pictures are desired, it is preferable to photograph the object, and a few words in regard to sketching and photographing the microscopical preparation will therefore be of value.

The alumni of a college, for instance, could do a great work for the furtherance of pharmaceutical education, if they become interested in such work, by photographing preparations of official and officinal drugs, and making lantern slides of the same; then the alumni association, gathering these from its various members, could from time to time, donate such collections to the college, enabling it year after year to illustrate more and more fully the subject of pharmacognosy. Many of the alumni are no doubt amateur photographers; why could they not occasionally photo-

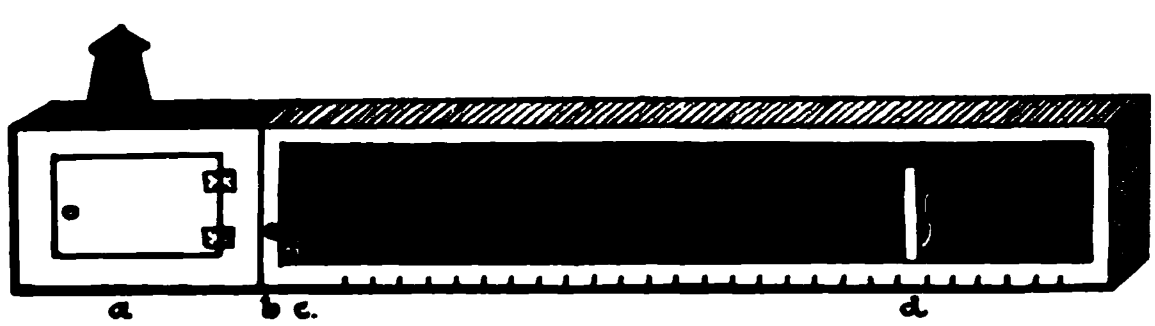


Fig. 9.

graph a nook in the fields or woods, a verdure-clothed bank by the road or streamside, a corner of the fence, etc., showing our indigenous medicinal plants as they grow. A photograph of a flowering branch, or a twig with fruit, showing the botanical features of these wild-growing plants in detail, would all be valuable and welcome additions to the illustrative material and appliances of any college of pharmacy, and each contributor to such a collection would not only have pleasure in the work itself, but would feel gratification in the thought that he had contributed to the success of the college of his choice, and the name on the label of his contribution would keep his name in grateful remembrance in the college.

It may interest some to know how to photograph microscopical preparations in an easy manner and without expensive apparatus. I therefore describe my own apparatus, which is illustrated herewith (Fig. 9). It consists of a wooden box, about five feet

in length; one end is a closed box (*a*) with door and Russian iron roof and chimney, made perfectly light-tight, even the holes for ventilation or draught being covered on the inside in such a manner that no ray of light can escape. The other part of the box is open on one side and the inside of this part of the box is stained a dull black. In this part a stand or frame (*d*) slides backward and forward, in which a hole 3¼x4¼ inches in size has been cut with its center exactly opposite the center of the lens, which will presently be described. The front of this hole is covered by a thin sheet zinc plate in which has been cut very accurately a hole three inches in diameter, and in such a manner that when a photographic plate is put in the frame behind the

Fig. 10.

zinc the hole will be centered over the plate, leaving about one-eighth of an inch of the plate above and below this margin of the zinc. The plate is held tightly in place by a spring clip. In the partition between the short closed and long open part of the box a hole is also cut and either within this wooden partition or on the side towards the open part of the box a sliding shutter is attached which can be pulled out and pushed in by a knob on the outside (*b*) and on the side towards the closed part of the box a brass plate with screw-thread to carry a microscope objective is firmly fastened. This is shown in Fig. 10.

The stage is movable, sliding in a groove, and may be moved back or forward by a milled wheel attached to a long screw, the focusing wheel being shown at *c* in Fig. 9. The upright stage is

like a plain microscope stage and holds the slide or object to be photographed by means of two spring clips.

Any method of illumination can be used; an electric incandescent light, a microscopic lamp with condenser, or a plain coal oil lamp with bull's eye condenser, or the whole apparatus may be open at the end opposite the stage and fitted into the shutter of a dark room so that a heliostat mirror may be made to throw direct sunlight on the object to be photographed. In this case, however, a dark room is necessary and the apparatus must fit into the shutter closely so that no rays of light are admitted. I prefer a coal oil or a Welsbach gas light.

To photograph with the latter light no dark room is necessary, any room answering the purpose on a dark night. Any dark room lantern with ruby light is used. To photograph, place the object on the stage, adjust the illumination and close the door to the closed part of the apparatus. The room should now be absolutely dark, but for the rays of light from the safety ruby lantern. In the carrier a porcelain plate, three and one-fourth by four and one-fourth inches in size, is to be placed so that the mat surface shows a white disc three inches in diameter through the hole in the zinc plate, and towards the lens. Open the shutter and move the carrier forward or backward with the right hand, at the same time working the focusing wheel with the left hand until the projected image is a little less in size than the focusing disc of porcelain; then use a focusing lens and adjust the focus accurately; this can be done much better in this manner than by light transmitted through ground glass at the back of a camera. If necessary, readjust the illumination so that the disc is evenly illuminated, and then close the shutter slide. Remove the porcelain plate and insert a three and one-fourth inches by four and one-fourth inches dry plate without moving the carrier. Then open the shutter and make the exposure, the length of time varying with the plates used, the objective employed and the distance of the carrier from the lens. A little experience will teach this very soon. The plate may then be placed in an envelope and marked with the name of the object and the number on the graduated part of the box. These graduations are arbitrary but equal distances apart; say one or two inches, and we prepare a table showing the rate of enlargement for every objective we use and all the marks on the

graduated box. Of course we make these tables by projecting a stage micrometer on the porcelain plate and measuring the projected image and calculating the degree of enlargement. The envelopes containing exposed plates may be put in a dark box until we have exposed a number; or we may develop each plate as soon as it is exposed so that if it is over or undertimed, we can expose another without the trouble of readjusting and refocusing.

Such plates, when finished, are intended for making standard size lantern slides by contact printing, but, of course, different sized carriers can be made for larger dry-plates. The apparatus should be made large enough for any sized plate it may be desirable to use.

My own preference for photographing whole sections, etc., is to use a low objective, a 72 mm., for instance, and move the carrier to a greater distance. A better result is obtained than by using a higher power at a shorter distance.

When the focusing is done, I take a little strip of opaque gummed paper, previously cut and kept assorted in boxes, according to the rate of enlargement, and paste it on a part of the unexposed plate, but within the circle of the zinc disc, outside of the image of the object, if possible; when the plate is developed, this strip comes off and leaves a transparent space, on which I draw with a fine pen and photo-engravers' ink a scale representing one millimeter divided into fifths of a millimeter, at the rate of enlargement indicated by the position of the plate carrier and the objective, as previously ascertained and already described. This scale is drawn as in the accompanying figure , and when a lantern slide is made it appears on the latter as a white scale on a black space. It is far more impressive in teaching the relative sizes of objects than any verbal statements of the rate of enlargement.

As to the photographing itself, i. e., the exposing, developing, etc., it does not differ from any other photographic work, but of course each one will probably have some preference for a certain make of dry-plates or a certain developer. For a good negative, with full delicate detail, I use only the "Hammer" plates. The Hammer Transparency Plates are best adapted.

This work is instructive, and I hope some of the alumni of the various colleges of pharmacy will become interested in it, and let

the colleges benefit by contributing lantern slides to the collections of their alma mater.

Some authors place much stress on drawing the objects examined. To me it always appeared to be a waste of time, but if drawings are wanted they may be made with the camera lucida, but preferably by arranging the microscope as shown in Fig. 11, and then projecting the image downwards on a piece of paper by means of a plane mirror or a rectangular reflecting prism. If the work is done at night no box is needed, a book or sheet of pasteboard between the paper and the lamp or source of light being sufficient. This is the easiest method of making a drawing.

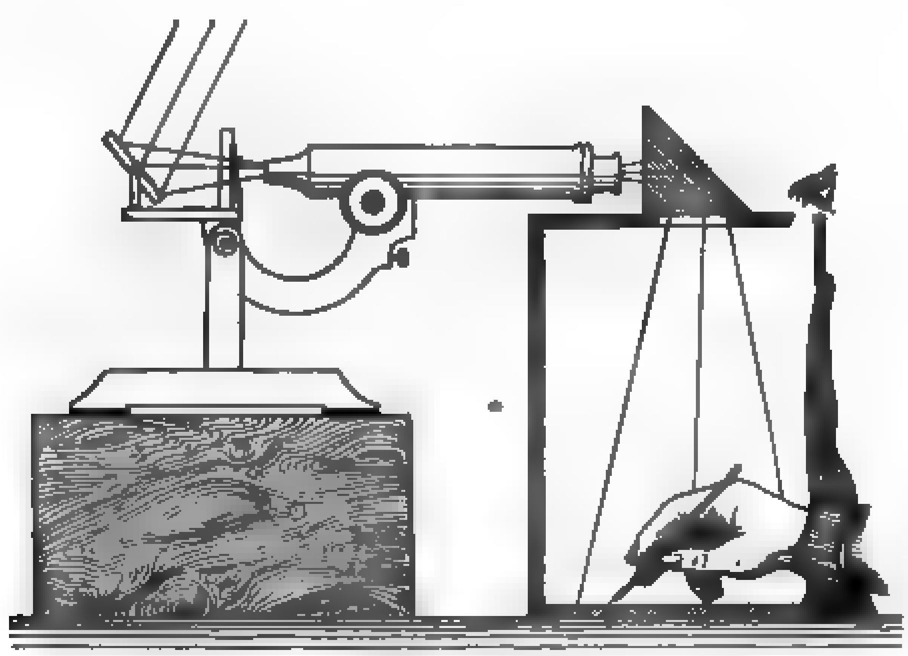


Fig. 11.

A little more difficult and at the same time expensive method, is to rule a piece of paper lightly with lead pencil into sixty-four squares, by drawing nine parallel lines each way at right angles to each other at equal distances apart, and then drawing a circle with one arm of the divider or compass at the point of crossing of lines in the center, and the circumference of the circle touching the four sides so that the entire circle is contained in the square. An optician can furnish an eye-piece to the microscope, with a glass disc ruled in the same manner, so that the field of the microscope, as determined by the diaphragm of the eye-piece, is divided exactly as the circle on the paper. The drawing may then be made by copying the image in the field of the microscope

off-hand. Still, but few who use the microscope are expert at making drawings, and except as memoranda or notes, these drawings have little value and photographs are preferable.

Further details of the work necessary for a proper use of the microscope should be obtained by every student in a college of pharmacy, by taking the instruction in the microscopical laboratories, and by those who are not students at colleges of pharmacy by studying some of the special works on microscopical technology. But for the purpose of following these lessons on pharmacognosy, the foregoing essentials may suffice.

VEGETABLE HISTOLOGY

It is not our object to enter on any lengthy consideration of the minute structures of plants from the standpoint of the botanist or the biologist but only from the standpoint of the pharmacognosist or druggist, and this chapter will treat therefore mainly of the elementary facts of vegetable histology. It is presumed that the student is familiar with general structural botany, as it is explained in Gray's Lessons in Botany; or if he is not, he should read that book carefully before proceeding with a study of these notes. If he has studied that little work he will have learned that notwithstanding the multiplicity of plants and the apparently infinite variety of forms, the structure is yet very simple when compared with the complex organisms of the animal kingdom. In the flowering plants, for instance, there are but three different parts, *root, stem* and *leaf,* which are metamorphosed or modified to answer all the varied requirements demanded of them by the growing plant, and all organs not at first sight recognizable as one of these three parts, may be shown to be such by a careful examination of the structure and function. As we recognize the same limb in the pectoral fin of the fish, the wing of a bird or bat, the paddle of the whale, the foreleg of a quadruped and the arms of apes and man, so we see the stem in branch or tendril, rhizome, tuber or bulb, or even in the pulpy mass of the fig or strawberry.

But while the external appearance of the organs of a plant may be very diversified, undergoing various modifications for many different purposes, we find little difference in the minute

structure. The student will therefore have comparatively little difficulty in understanding this subject, especially as in pharmacognosy we have little or nothing to do with the living processes in the plant cells or with the phenomena to be observed in living protoplasm, but only with "formed" materials, cell walls, crystals, starches, oils, resin, etc.

If we examine a small portion of any part of a plant under the microscope we will find it to be made up of small structures which are called *cells*. In the lower orders of plants, the *Algæ*, etc., we may find plants consisting of single cells, or of rows of cells of the thickness of only one cell, and in some of these we can study the phenomena of plant life and cell-structure to good advantage. But we can also study the plant-cells as we find them in the higher plants, and especially in the more succulent or growing parts of the stem, leaf or root, or in the pulpy portion of fruits, such as apples, cranberry, strawberry, etc.

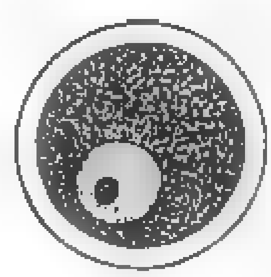


Fig. 12.

The cell (Fig. 12) consists of a cell wall composed of *cellulose*, enveloping a substance which is called *protoplasm*, and within this is a small body termed a *nucleus*, within which in turn may be one or more smaller bodies called *nucleolus* (sing.) or *nucleoli* (pl.).

The cell wall may be absent in some of the lowest forms of vegetable life, when the cells are called *naked* or *free* protoplasm, etc., as in the amœba, and some young algæ; or the nucleus is not seen, although this is often due to the fact that protoplasm and nucleus are of the same density and transparency, in which case the nucleus can, however, be demonstrated by staining it by soaking the preparation in some staining solution, as in a solution of hæmatoxylin or in a solution of carmine in water made slightly alkaline by the addition of ammonia and afterwards washing in a weak solution of acetic acid. Still, this is not necessary to be

done in the study of pharmacognosy. The figure shows the essential structure of a cell, in the primordial cell of *Stephanosphæra pluvialis*, after Sachs, and as the cell is single, not pressed upon by other cells, it is round, which may be said to be the normal and typical shape of a cell.

Many druggists have an aquarium in which a small plant with long grass-like blades is cultivated. This plant is the *Vallisneria spiralis* and it offers an opportunity of examining the cells which should not be neglected. Take out a large leaf, those turning slightly yellow being best for the purpose. With a sharp knife or razor cut it into thin longitudinal sections and place one of these on a slide under a cover glass and keep moist with water, taking care that the water does not wet the upper surface of the cover glass. Examine with an objective of comparatively high power, say a 4 mm. or 3 mm. objective. As there are many cells pressing each other, the cells are compressed and will appear in such a section to be quadrangular. The protoplasm flows around the interior of the cell in a steady current, carrying with it the green chlorophyll bodies and the large transparent colorless nucleus, which is, however, readily seen because its refractive power differs from that of the protoplasm and the cell fluids; the cell walls are also plainly seen.

In ordinary language we often speak of the vegetable cell when we really mean the empty cell wall, as in the microscopical preparations from which we have removed the cell contents as already explained, but we should not forget that this use of the word "cell" in describing the structure of a drug is conventional and not scientifically correct. The cell wall is formed from and by the protoplasm, and once formed is not reabsorbed. It is alive only in the sense in which hair or fingernails are alive; it is called "formed" material, and once formed remains even after all life has ceased in the cell and the protoplasm has all been absorbed from the cell.

The size of vegetable cells is extremely variable, for while the average cell is stated by Carpenter to be about 0.085 millimeter (1/300 inch) in diameter, there are cells fully 0.85 millimeter (1/30 inch) in size and others less than 0.0085 millimeter (1/3000 inch) in diameter.

As already stated, the typical shape of a single cell is round, but it may also occasionally be oval (*a* and *b* in Fig. 13). When cells are joined together, mutual pressure at the points of contact is apt to modify the shape, as in the long thread-like filaments of many algæ, when the cells become cylindrical, as in *c;* and this shape is also found in the soft interiors of many plants in which the aggregations of cells is not a mere thread, as in the soft parts of sarsaparilla. If only a few cells are joined to form a vegetable hair, the individual cell may assume the conical shape shown in *d*.

But in the interior parts of plants it is more common that the

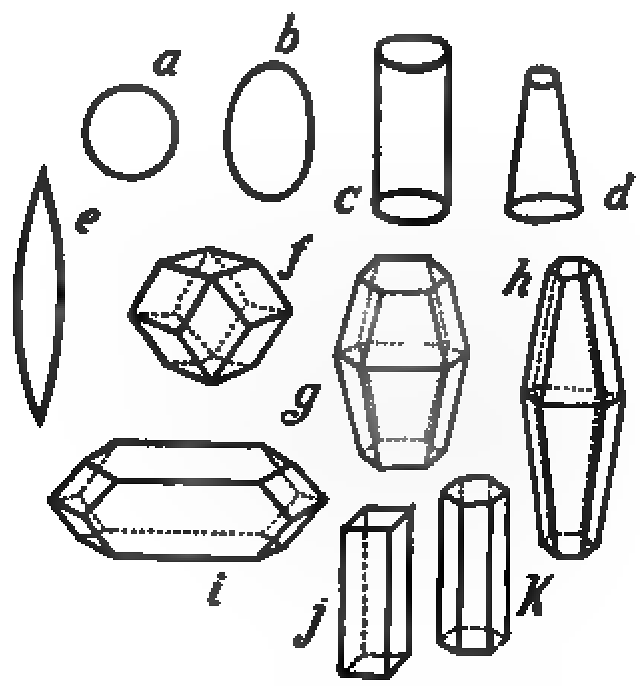


Fig. 13.

cells are compressed from all directions, and the shape becomes more or less regularly twelve-sided, as in *f*, which in section will appear as six-sided; and if the growth is more rapid in one direction than in others the cells will be elongated in that direction as in *g* and *h*, but they will still appear six-sided on section.

Occasionally the cells may be more or less prismatic in shape, as in *i*, *j*, or *k*, but this is not common. All such cells abutting on each other with broad surfaces are parenchymatous cells; they are usually not much longer than they are broad, and are usually soft-walled, and therefore they do not give much strength to the plant.

An important modification of the shape of cells is that figured

at *e*, where the cell is shown as elongated and pointed at the ends, the fusiform or spindle-shaped cell; in the tissues of the plant the ends of these cells interlace and as they are usually hardened, or lignified (woody), they give strength to plants. The wood of our trees, for example, is made up of such fusiform cells which often are ten or even a hundred times as long as they are broad, and these cells are called prosenchymatous cells.

When the cell is young it is completely filled with protoplasm, a portion of which is differentiated from the remainder so as to form the nucleus. The cell wall may be scarcely more than a delicate layer on the outside of the cell in its earlier stages, but

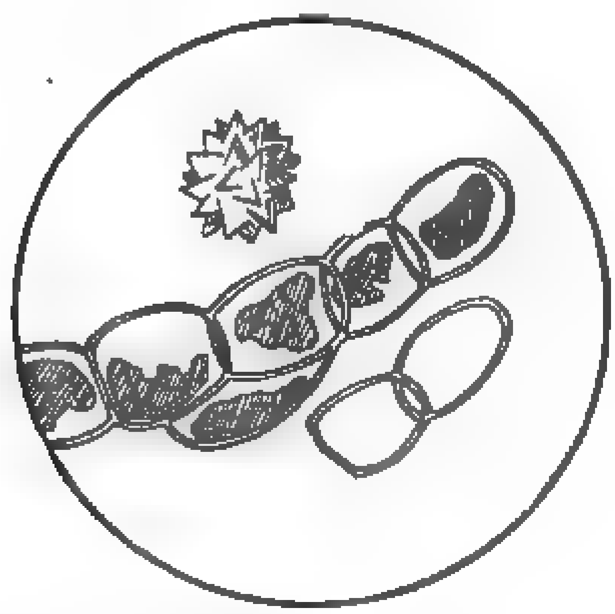


Fig. 14

this soon becomes surrounded with a denser wall of cellulose. When a cell of this kind is subjected to the action of any medium capable of attracting water from the protoplasm the latter will shrink away from the cell-wall and will then appear to be surrounded by a delicate membrane which is called the "primordial utricle;" but this membrane is possibly only a product of the chemical action of the medium on the protoplasm, and is probably no more a membrane than is seen when we carefully open an egg into boiling water, when the white of egg on the outside at once coagulates and appears to be a white membrane around the still transparent albumen within.

This contraction of the protoplasm by the action of reagents, such as glycerin, alcohol, etc., is seen in Fig. 14, which repre-

sents cells from rhubarb root, taken from the soft mass left after making an infusion and then placing in alcohol; two of the cells are shown empty; the others show contracted protoplasm.

The angular mass represents the stellate crystals of oxalate of lime which are plentiful in rhubarb root.

As the cell grows older and larger, spaces occur in the protoplasm which are filled with a watery fluid; such spaces are called *vacuoles,* and the fluid which they contain is called the *cell-sap,* which increases in volume until the protoplasm occupies but a small part of the cell contiguous to the cell wall and finally disappears altogether. The cell then ceases to take active part in the life of the plant and serves mechanically by osmosis through its cell walls, or by capillary attraction, to carry moisture from the rootlets to the growing and living cells of the plant. At last this too may cease and the dry cell, empty or filled with mineral or other deposits, as in the inner or heartwood of trees, serves only as mechanical support to the living tissues.

From the protoplasm may be elaborated various organic substances which are of importance in the economy of the plant; and the moisture taken from the soil holds in solution more or less inorganic material which is carried up into the tissues of the plant, where it is finally deposited without, however, necessarily taking part in the life processes of the plant.

As evaporation of moisture from the plant takes place mainly from the leaves it is here that much of this inorganic material is deposited, and upon burning different parts of plants and weighing the residue it is found that leaves leave the largest percentage of ash.

In the tissues of the plant inorganic substances are deposited in various forms, often in combination with organic acids constituting some of the proximate principles of the plant; sometimes they are deposited in the cell walls, in the form of small crystals, or the whole cell wall may be so loaded with inorganic material that it will retain its shape even when the organic materials have been destroyed, as in diatoms, or in the epidermis of *Equisetum,* in which silica is deposited.

Or lime salts are deposited in the interior of the cell, in the protoplasm; either in single crystals, as in the epidermal cells of onion peel, or in bundles of long slender crystals, as in the stem

of lilies or of fuchsia, or in skunk-cabbage, when they are called *raphides*, a Latin word meaning needles; or the crystals may be in stellate aggregations, as in the oxalate of lime crystals in rhubarb, shown in the last illustration (Fig. 14), which are generally spoken of as "rosette" crystals.

Protoplasm is an indispensable part of the cell-contents of every living cell, but it is of little interest to the student of pharmacognosy, who is mainly concerned with those substances which have definite form when seen under the microscope. Of the almost innumerable organic substances that are found in plants starch is of most interest in the study of drugs, because its various forms may help to distinguish one drug from another, al-

Fig. 15.

though in examining powdered drugs it may occasionally be necessary to apply chemical tests to determine some of the formless constituents of the cells.

Starch is found in most plants and consists of more or less regular grains with a structure that is often characteristic of the plant or drug. Typical grains of starch may be obtained for study by slicing a potato and pressing the cut surface against a glass slide, placing a drop of water on this and covering with a thin cover glass and examining with a high power objective. In Fig. 15 we see several large grains of potato starch, the oval form being most common, although quite a number are irregular from mutual compression in the cells, and a few are com-

pound by the adhesion of two or more. By making a section of the potato at right angles to the surface and mounting in water or glycerin the extent to which starch grains are crowded in the cells may be seen. In potato starch the size varies considerably, large, intermediate and small grains being plentifully found; in wheat starch there are large numbers of large round grains and of quite small grains and few of intermediate size; while in corn starch nearly all grains are of uniform size.

Most kinds of starch show peculiar layers or concentric markings around a dot or "hilum," which is generally excentric. If examined with the polariscope, starch is seen to polarize light with a cross radiating from the hilum, as shown in Fig. 16.

Starch is to the plant what fat is to an animal—surplus food material stored up for future use.

If, in examining a drug, we are in doubt about the nature of any grains we see, we may test for starch by soaking the sub-

Fig. 16.

stance under examination in watery solution containing free iodine, as for instance, a few drops of tincture of iodine in water, to which a grain or two of iodide of potassium may be added; this will stain the starch grains blue.

In some plants, especially Compositae, no starch is found, and the food material is not deposited in solid form but remains in solution. This substance is inulin, but it is of little interest to the pharmacognosist. If a drug containing inulin is soaked for some days in alcohol the inulin is precipitated and becomes aggregated in spherical masses of an apparently radiating crystalline structure, forming "sphæro-crystals;" these sometimes occupy several adjacent cells; the cell walls apparently not interfering with their arrangement. Iodine stains inulin yellowish-

brown by the mechanical deposit of iodine in the fissures of the sphæro-crystals, and not by any real staining effect.

Aleurone grains are found exclusively in seeds, especially oily ones. They are food reserve in the form of rounded or oval grains resembling starch grains, but are not colored blue by iodine. They appear to be homogeneous until they are cleared by soaking in glycerin, when they are seen to contain a *crystalloid* or *globoid* body in the interior. Aleurone grains consist of albuminoid or protein substances, the crystalloids of calcium oxalate and the globoids of calcium and magnesium phosphate. Aleurone is generally soluble in water, and sections intended to show these grains must be examined in glycerin. Aleurone is of little importance to the pharmacognosist, although when peas or beans are added as adulterations to powdered drugs, the presence of aleurone grains may establish the fact of adulteration.

Other protein grains, etc., are sometimes produced by precipitating the protein substances that are held in solution in the protoplasm and cell-sap; they do not naturally assume regular forms recognizable under the microscope, and while they are of interest to the student of vegetable histology and physiology, they are of little or no interest to the pharmacognosist. The same is true of most other organic compounds, as sugars, tannin, extractives, alkaloids, glucosides, etc.

Fixed oils are often visible in the form of highly refractive drops or globules. Resin masses, which are often deposited in special ducts or cells, may be identified by soaking the section in tincture of alkanna diluted with water, when the resin becomes colored brilliantly red; or by soaking in a watery solution of acetate of copper, when it becomes emerald green, but the staining in the latter solution requires several days.

The simplest and primary cell wall is cellulose. As we see the cell walls in a section of a drug, the partition between any two cells is composed of the cell walls of the two cells united by an interposed cell cement, and under low powers and without differential staining it looks like one cell wall. Ordinarily we speak of the empty cells consisting merely of sections of cell walls, as in sections from which the cell-contents have been removed by the treatment spoken of when telling about the making of sections, as "cells," and a pharmacognosist is not much in-

terested in any other cells; so that pharmacognosy is mainly concerned with the empty cell walls.

Parenchymatous cells usually have cellulose walls. As plants grow older various changes occur in the cell walls; for instance, the thin epidermal cells of leaves change by a development of cuticle, a peculiar layer of cells the outer part of which is thickened and impervious to water; still later, on the branches and roots this cuticle becomes replaced by suber or cork, a more or less thick deposit of a different kind of cell, which is even more impermeable to water than the cuticle.

Prosenchymatous cells often become lignified—that is, the cell wall is changed to lignin, a hard and tough material forming wood. The wood of plants is composed of this modification of

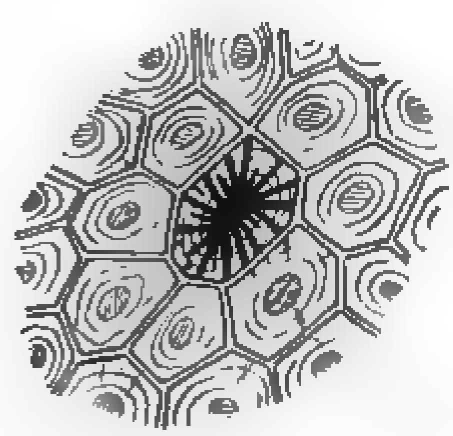


Fig. 17.

cell wall, and it serves for mechanical support of the plant.

A similar modification of the cell wall is that by deposition of sclerogen (lignin?) within the original cellulose wall. This substance is deposited in layers, one within another, until the cell is often nearly filled with this material. But there are little pores which remain open, making communication from one cell to another by osmosis through the cellulose wall possible (Fig. 17). In the illustration we see **sclerenchymatous cells** from the carpel of star anise, all but one having these small pores filled with Canada balsam, so that they cannot be seen, while in one they are filled with air, which renders them plainly perceptible. The stones of fruits and the gritty particles in pears furnish interesting cells of this kind, but when they are found scattered among parenchymatous cells, as when they occur in the middle part of a bark, or scattered in the fleshy part of the pear, they

are called "stone cells." Such cells are usually nearly round, while the sclerenchymatous cells which are found in the bast portion of the bark are also prosenchymatous or spindle-shaped. The stony shells of nuts furnish fine examples of stone cells.

In Fig. 18 we see a transverse section of the bast cells of cinchona bark, showing plainly how the small canals that run through the layers of sclerogen communicate with those in an adjacent cell. If we look down on the end of one of these small canals it will appear as a dot, and when the deposit is very thin the cell will look as if it was dotted, and it is then called a "dotted cell;" of this, beautiful examples can be found in Areca nut. Dotted cells may, however, be of lignin as well.

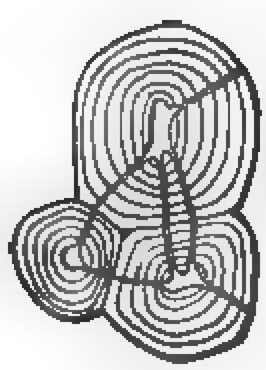


Fig. 18.

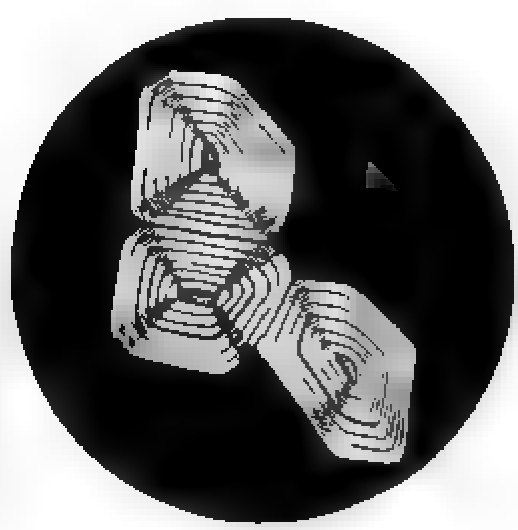


Fig 19.

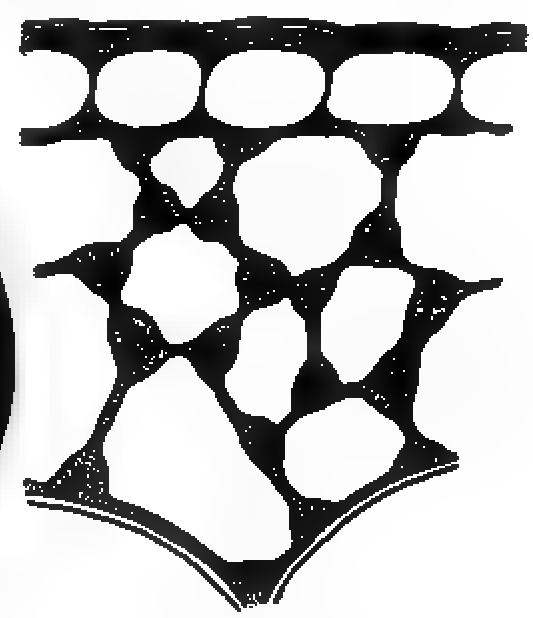


Fig. 20.

Sclerenchymatous cells polarize light, and a cross section of such a cell will show a polarization cross, as shown in this illustration of three cinchona bast cells under the polariscope (Fig. 19).

The distribution of sclerenchymatous cells among the other cells of a plant or drug often gives such a characteristic appearance, that it becomes a valuable feature for the recognition of the drug. We have already learned that the words "parenchyma" and "prosenchyma" refer to the shapes of cells; the word "sclerenchyma" refers to the peculiar thickening of the cell wall, and sclerenchymatous cells may be either parenchymatous or prosenchymatous in shape.

Under the epidermis of the cotyledons of many seeds, as well

as under the epidermis of young twigs, petioles and midribs of leaves, etc., we sometimes find a peculiar kind of cells and of tissue, which we have not heretofore considered. To support the tender epidermis there may be developed from the fundamental tissue certain hard-walled cells, as for instance the sclerenchymatous cells under the epidermis of sarsaparilla root, or the stone cells which constitute the outer layer of the middle bark of cinnamon, or the sclerenchymatous cells under the epidermis of the fruit of cubeb. But in some cases, especially in the positions re-

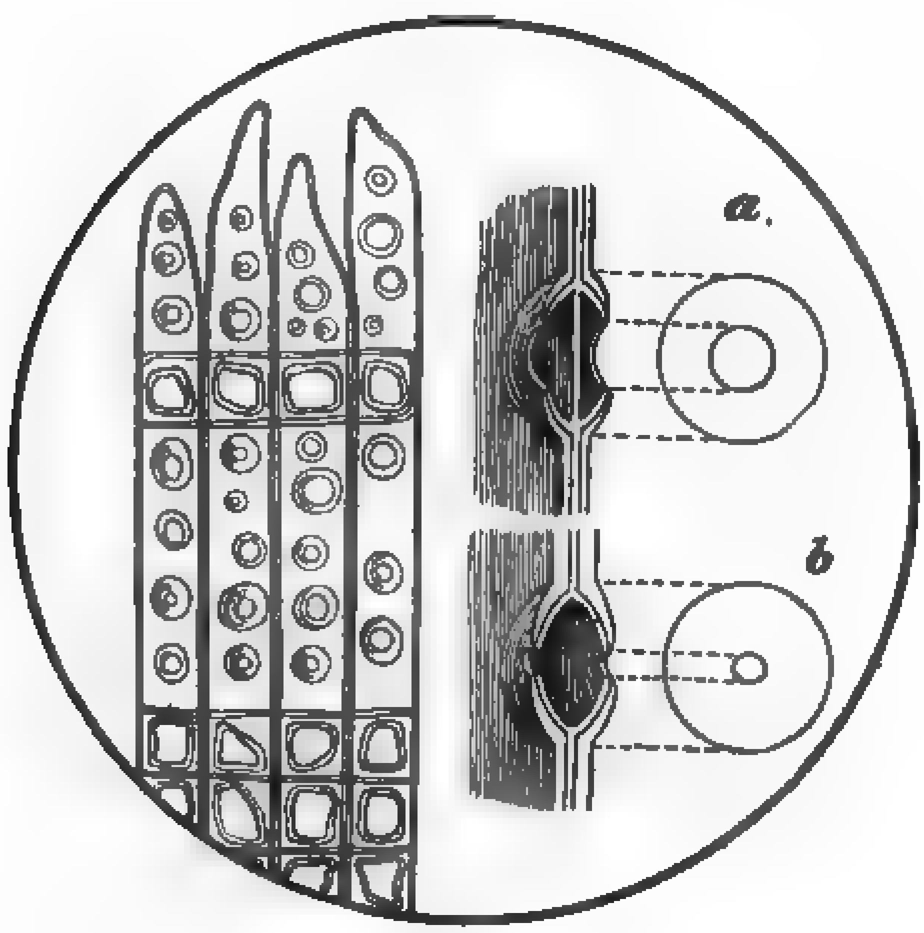


Fig. 21.

ferred to above, the walls of such supporting cells for the epidermis become thickened very much in the angles of the cells and but little elsewhere; these cells are called *collenchymatous cells* and the tissue formed by them constitutes *collenchyma* or *collenchymatous tissue*. This kind of cells and tissue is, however, of quite subordinate importance to the pharmacognosist, but may sometimes help to some trifling extent in recognizing powdered seeds, or powdered leaves from which the petioles, etc., have been imperfectly removed in garbling, and their nature is therefore briefly referred to here (Fig. 20).

Peculiar round dots or pores are found in the wood cells of conifers, which are characteristic of that class of plants, and which are shown in the drawing of the wood cells of Pinus sylvestris (Fig. 21); a thickening of the cell wall at first leaves a larger circular space, but this gradually becomes narrowed until we see the appearance as in *a*, a section of the cell wall also being shown; at *b* we see an older formation, the original cellulose cell wall having been absorbed, thus allowing direct communication from cell to cell. Cells of this kind are called "pitted cells." Each such pit polarizes light with a beautiful polarization cross.

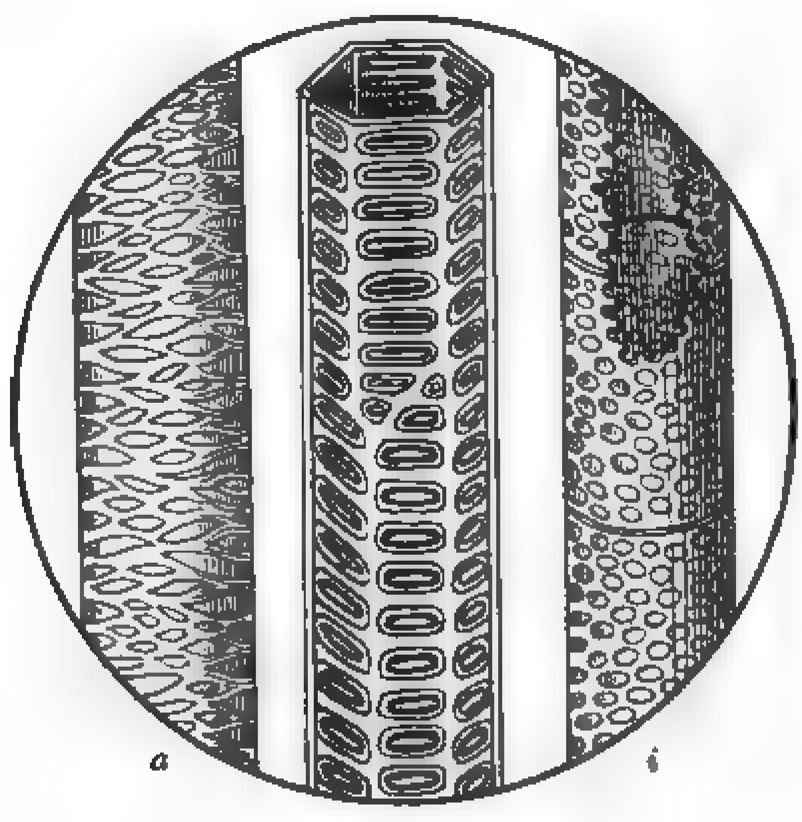


Fig. 22.

In many plants we find ducts or tracheids, consisting of large cylindrical cells joined at their ends, the partition walls afterwards being absorbed, thus producing long continuous tubes or vessels. Thickening by the deposit of lignin or sclerogen may take place in these ducts, as in simple cells, giving rise to variations in appearance, which are designated by distinguishing names. When the thickening is interrupted by small and circular pores, whether in the cell or in a duct, we say these structures are *dotted;* a dotted duct is seen in *i*, in Fig. 22. In *reticulated* ducts the pores are a little longer in a transverse than in a longitudinal direction, thus making the cell walls look like the meshes

of a net as in *a*. When these meshes are regularly arranged in rows, the appearance may be similar to that of the rounds of a ladder; such ducts are called *scalariform*, of which fine examples may be seen in ferns, and such a duct is shown in *e*.

This resemblance to a ladder may be a little less evident, as in *y* of Fig. 23; but it is still a scalariform duct, but already indicating variations which lead to a deposit of sclerogen in spiral bands, as in *u*, which forms the *spiral* ducts. Other ducts have spirals interrupted with circular bands, as in *o*, while still others have the thickening only in circular bands, forming the *annular* ducts. All possible gradations or combinations between these different

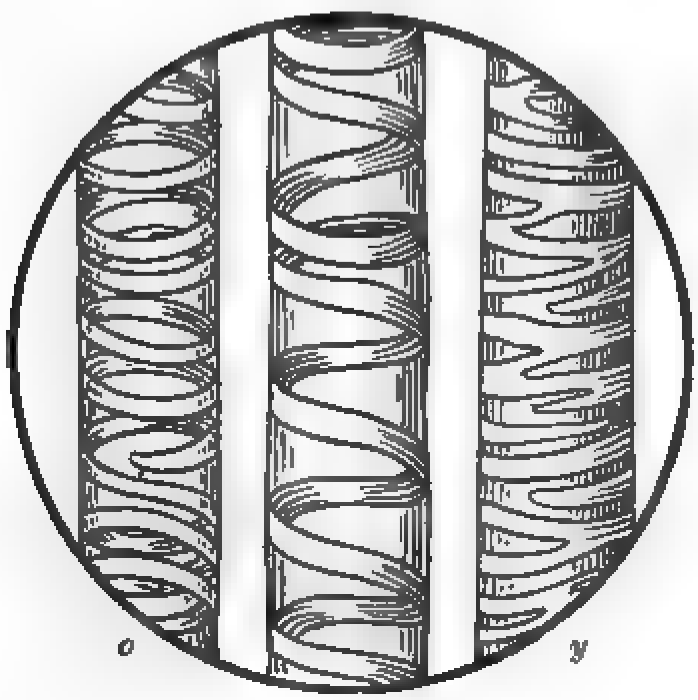


Fig. 23.

methods of thickening may, however, be found in the same duct. These ducts are found in the wood portion of plants.

Still another form of duct which is of great importance in the life-economy of the plant, but of little importance from a pharmacognosy point of view, is the *sieve* duct which is found in the bast of plants, and in which the thickening takes place only in the partitions between the different cells constituting the duct, which partitions are permanent and thickened like dotted ducts so as to resemble sieves placed between the cells.

Latex ducts, or *laticiferous* ducts or vessels may be formed by the coalescence of cells, so that they form anastomosing vessels; they contain *latex*, a peculiar substance containing oil, resin, caout-

chouc, gum, etc., with water, in an emulsion, sometimes limpid, more frequently milky.

Laticiferous ducts must not be confounded with *lactiferous* ducts, which occur in the mammary glands of animals, and which convey *lac* or milk. Some writers say "*lacticiferous*," which is an inexcusable blunder.

Intercellular spaces, with no walls of their own, but formed by the surrounding cells, as flues in chimneys are bounded by the bricks, may serve as ducts, sometimes containing air, as in many water plants, sometimes latex, oil, etc., as in the oil ducts of anise or fennel; when such spaces are nearly spherical they are sometimes called *glands,* although not properly such, as in orange-peel, cloves, etc.

All these different forms of cell and duct formations unite to form *tissues.* A tissue may be described as a union of many cells for the performance of a common function. According to Flueckiger, the different systems of tissues are:—

Epidermal System.—In its simplest form merely a thickening of the outer wall of the outer cells, as in some thallogens; in higher plants, a layer of cells, forming the epidermis, in and on which we find stomata or breathing pores, hairs, glands, etc. On roots and stems this epidermis is later on replaced by the formation of cork (periderm). The epidermal structures protect the more delicate structures within, and also prevent too rapid or excessive evaporation.

Mechanical System.—This serves to give mechanical strength to the plant. It includes wood cells, bast cells, stone cells, etc. The wood or *xylem* portion of fibro-vascular bundles belongs here.

Absorbing System.—Structures by which food is obtained from the soil, or in parasitic plants from their hosts; of little importance in pharmacognosy. The root hairs belong to this system.

Assimilating System.—Consists of cells containing chlorophyll, therefore in the higher plants mainly the leaves.

Conducting System.—The fibro-vascular bundles; ducts, sieve-ducts, etc. This system permits the passage of food materials, water, etc., from one part of a plant to another.

Storing System.—Receptacles for storing surplus food, such as seeds, fruits, rhizomes, bulbs, roots, etc. Strictly speaking, seeds fruits, etc., are not "tissues" but "organs."

Aërating System.—Stomata and intercellular spaces to effect the interchange of gases in the interior of the plant.

Secretion Storage.—To receive and store the secretions of the plant, as oil, resin, mucilage, etc. It includes intercellular spaces, cells, latex ducts, glands, etc.

While a study of these systems of tissues is important from the botanical standpoint and even essential to a proper understanding of physiological botany, it must yet be remembered that the pharmacist has no more use for botany *as such* than has the physician, lawyer or preacher, or than has an architect, civil engineer or stonemason for geology or mineralogy, and it is only in so far as a knowledge of botany is of use in pharmacognosy that it is necessary to a pharmacist's education. *Pharmacognosy deals with the anatomical and chemical facts alone,* and it is a divergence and misapplication of time to study botany (as the tendency seems now to be) from the botanist's standpoint. For instance, in studying physiological botany, we should want to study chlorophyll grains with reference to their functions as assimilating organs, and how they produce starch grains, which in turn we would study from their first inception in the chlorophyll bodies to the final perfect shapes in the cell. In pharmacognosy we only need to know chlorophyll bodies and starch grains when we see them, and only want to know whether certain structures are present or not, and if present, what they look like.

We will therefore study the tissues of the drugs from a purely anatomical standpoint and in connection with the parts of plants in which they occur, and will next proceed to the consideration of the pharmacognosy of vegetable drugs.

Adulterations

Drugs may be debased or tampered with in various ways. We meet with adulterations, sophistications, admixtures and substitutions.

An adulteration is an addition of foreign substances to any article with the intention to defraud. When extract of poppy leaves is added to opium, or when leaden bullets or shot are inclosed in lumps of opium to increase the weight, these are adul-

terations. But it is also adulteration when cheaper drugs of similar appearance or inferior or spoiled drugs of the same kind are added with intent to defraud.

Sophistication is an addition of a spurious article closely resembling the true, as paraffin to white wax. A sophistication is, therefore, always an adulteration; but as an adulteration is not necessarily an imitation of the genuine, an adulteration is not necessarily a sophistication.

Adulterations and sophistications always imply intentional fraud, and the nature of the adulterant is usually such that its use cannot exert any immediately injurious effects, however deleterious the ultimate effects may be, for no one is depraved or foolish enough to risk an immediately fatal effect for the sake of pecuniary gain.

An admixture is the addition of one drug to another, and may be intentional, when it constitutes an adulteration; but the term is usually restricted to those cases when the admixture is due to accident or ignorance, and with no intenton to defraud; the circumstances of the case generally show whether the admixture is due to one or the other of these causes, as when the added article is more expensive than the drug, or when it is dangerous to health or life, when it is evidently unintentional and not in any sense an adulteration.

A substitution is when an entirely different substance is sold instead of the one asked for. Such substitution may, of course, be intentional, and, therefore, for fraudulent purposes, as when ceresin is sold instead of beeswax, cottonseed oil for olive oil, or Mexican sarsaparilla for Rio Negro sarsaparilla; but such fraudulent substitution would not be an adulteration because the latter presupposes an intentional cheapening of the genuine article, and in cases of substitution none of the genuine article is present at all. A substitution may also be unintentional, as when through ignorance one drug is sold for another resembling it, or when labels are accidentally interchanged, or when the similarity of names leads to the sale of a wrong article, as in a case where *apocynum cannabinum* was sold instead of *cannabis Indica* which had been ordered; but the label was "Cannabis Indica." Here the use of the English name "Indian Hemp" for both drugs led to the

mistake. Substitutions may furthermore result from carelessness, as when morphine is dispensed instead of quinine.

It will therefore be seen that each of these terms—adulteration, sophistication, admixture and substitution—has a distinct meaning, and that they should not be indiscriminately used, one for another. The first two terms always imply fraud; the other two sometimes imply fraud, but frequently imply ignorance or carelessness. Adulterations and sophistications, therefore, seldom directly lead to dangerous results, while admixtures and especially substitutions, frequently give rise to serious or even fatal accidents.

Formerly much attention was given to a study of adulterants, these being described with the same minuteness as the drugs themselves, but now we generally restrict our study to the drugs, counting all that does not answer the description of the drug under consideration to be foreign substance, and therefore one of the above forms of debasement. Adulterations that are of common occurrence or of characteristic nature will be described in these notes. We proceed now to the consideration of the pharmacognosy of the individual vegetable drugs.

GROUP IX

Herbs—Whole Plants Botanically Recognizable

While herbs or flowering tops are usually sufficiently complete to be recognized by their botanical characteristics, yet as a matter of fact works like Maisch's *Organic Materia Medica* do not classify them systematically as fresh plants are classified, for instance, in Gray's *Manual*.

Moreover, by looking over the group list, it will be seen that there are comparatively few whole flowering plants used as drugs, and even these are of subordinate importance, so that to study taxonomy for the sake of recognizing these few, reminds one of the mountain heaving in labor to produce a mouse.

A large number of herbs and other "botanical drugs" are sold in compressed packages, and the retailer sells these as labeled and without opening the packages to determine the identity of the drugs, which, moreover, are often cut up before compression so as to be unrecognizable by their botanical features, when, of course, other characteristics, such as odor or taste, must be

relied on for identification. In any case, however, these drugs must be softened by dipping in hot water, or by holding in the steam escaping from a tea kettle, so that they may be properly handled for examination. The flowers of most of these plants are very minute and must be examined with a lens. In the following drawings in this group most of them are represented much enlarged.

In pharmacognosy, while it is theoretically assumed that herbs are classified botanically, yet the books give such other methods of identifying these drugs as to make a knowledge of taxonomy practically superfluous, as will be appreciated by reference to this group in Maisch. It is true that at present, in some quarters, pharmacognosy is taught by botanists as if botany were the important study, and pharmacognosy but an incident to it, while in reality botany is and should be but a subordinate incident to the study of pharmacognosy.

As a matter of fact, the best and easiest way to learn to recognize the drugs of this group is to get a sample of each drug and become familiar with its appearance, taste and odor, and in this way the same result may be reached in a few days that would require a year or two of practice in recognizing plants botanically, especially as many of the drugs of this group are not always in a condition for botanical determination, while the other characteristics are always present.

The following is an enumeration of the more important drugs of this class, arranged alphabetically according to the orders to which they belong, although no great stress is intended to be placed on the orders or families.

COMPOSITÆ.

Leaves and tops.................................... **Absinthium.**
Leaves and flowering tops.......................... **Achillea.**
Flowering tops..................................... **Eupatorium.**
Leaves and flowering tops.......................... **Grindelia.**
Leaves and flowering tops.......................... **Solidago.**
Leaves and tops.................................... **Tanacetum.**

GENTIANACEÆ.

Entire plant....................................... **Chirata.**

LABIATÆ.

Leaves and tops.................................... **Cataria.**
Leaves and tops.................................... **Hedeoma.**

Leaves and tops.................................**Lycopus.**
Leaves and tops.................................**Majorana.**
Leaves and tops.................................**Marrubium.**
Leaves and tops.................................**Melissa.**
Leaves and tops.................................**Mentha piperita.**
Leaves and tops.................................**Mentha viridis.**
Leaves and tops.................................**Monarda.**
Herb ....**Scutellaria.**

LEGUMINOSÆ.

Tops ....**Scoparius.**

LOBELIACEÆ.

Leaves and tops.................................**Lobelia.**

PAPAVERACEÆ.

Entire plant....................................**Chelidonium.**

RANUNCULACEÆ.

Entire plant....................................**Coptis.**
Herb ....**Pulsatilla.**

SOLANACEÆ.

Leaves and flowering tops.......................**Hyoscyamus.**

URTICACEÆ.

Flowering tops of female plant..................**Cannabis Indica**

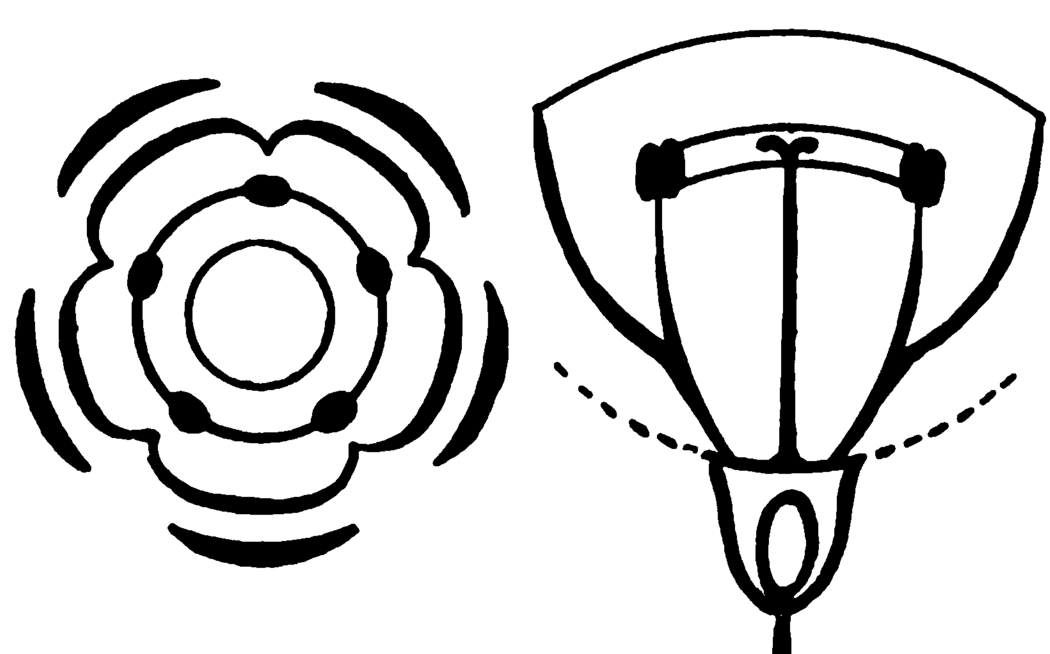


Fig. 24.

It must be remembered that drugs which should consist of only leaves, as belladonna, aconite, eucalyptus or chimaphila leaves, or only of flowers, as matricaria, etc., often come into the trade in the shape of twigs or tops and may then also appear to belong to this group. Such drugs are described under the proper groups to which they belong.

COMPOSITÆ.—*Flowers in a close head, on a common receptacle,*

surrounded with an involucre, with five (rarely four) stamens inserted on the corolla, their anthers united in a tube (syngenesious). (Fig. 24.)

Yellowish florets; leaves petiolate, pinnatifid.............	**Absinthium.**
White florets; leaves thrice pinnatifid....................	**Achillea.**
White florets; leaves connate-perfoliate..................	**Eupatorium.**
Yellow ray florets; leaves sessile, spatulate to lanceolate..	**Grindelia.**
Yellow florets; leaves linear-lanceolate.................	**Solidago.**
Yellow tubular florets; leaves alternate, pinnatifid........	**Tanacetum.**

Absinthium

N. Wormwood.—**O.** Leaves and tops of ***Artemisia Absinthium; Compositæ.***—**H.** Northern temperate zone; cultivated.—**D.** Leaves about five cm. long, hoary, silky pubescent, petiolate, roundish-

Fig. 25.

triangular in outline; pinnately two or three cleft with lanceolate segments, the terminal one spatulate; bracts three cleft or entire; heads numerous, about three mm. long, subglobose; numerous small, pale yellow florets, all tubular and without pappus; odor aromatic; taste persistently bitter.—**C.** Volatile oil, bitter glucoside, absinthin, etc.—**U.** Bitter tonic and stimulant. Dose: 1 to 5 grams in infusion, tincture or fluid extract.

Achillea

N. Yarrow, Milfoil.—**O.** Flowering tops and leaves of ***Achillea Millefolium; Compositæ.***—**H.** Northern temperate zone.—**D.** Leaves from five to twenty-five cm. long, three pinnatifid, the divisions linear, three to five cleft, crowded; corymb compound, flat-topped; involucre oblong with imbricate scales; rays four to five, short,

white (sometimes rose-color); disc-florets greenish-white, perfect; achenes flat and without pappus; odor aromatic, reminding somewhat of chamomile; taste bitter. Should be free from coarse stems.—**C.** Volatile oil and a peculiar principle, achillein, etc.—

Fig. 26.

U. Aromatic, stomachic, bitter tonic; similar to chamomile. Also supposed to act as an emmenagogue. Dose: 1 to 5 grams, in infusion or fluid extract.

Eupatorium

N. Boneset, Thoroughwort.—**O.** Flowering tops and leaves of *Eupatorium perfoliatum; Compositæ.*—**H.** North America.—**D.** Stem hairy; leaves lanceolate, united at the base around the stem (connate-perfoliate), tapering to a slender point, serrate, very veiny, wrinkled, downy beneath, ten to twenty cm. long; flower-

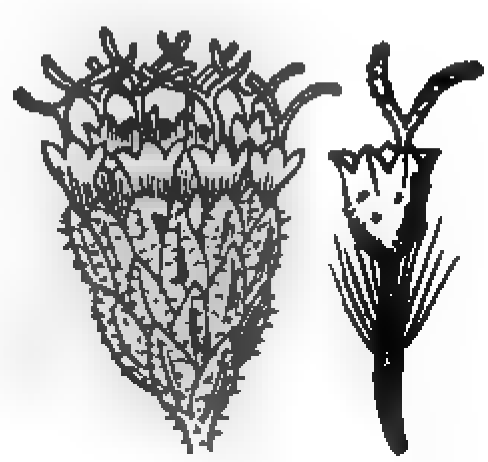


Fig. 27.

heads with ten to thirty white florets; corymbs compound and large; scales of involucre linear-lanceolate.—**C.** A bitter extractive, a glucoside eupatorin, etc.—**U.** Bitter tonic, useful in intermittent fever, dyspepsia, general debility, etc.—The warm in-

fusion is an excellent emetic and diaphoretic. Dose: 1 to 5 grams, best given in infusion or fluid extract.

Grindelia

N. Grindelia.—**O.** Leaves and flowering tops of *Grindelia robusta (Grindelia camporum, or Grindelia cuneifolia)*, and *G. squarrosa; Compositæ*.—**H.** *G. rob.* west of the Rocky Mountains; *G. squarr.* from the Mississippi westward to the coast.—**D.** Leaves about five cm. or less long, varying from broadly spatulate or oblong to lanceolate, sessile or clasping, obtuse, more or less sharply serrate,

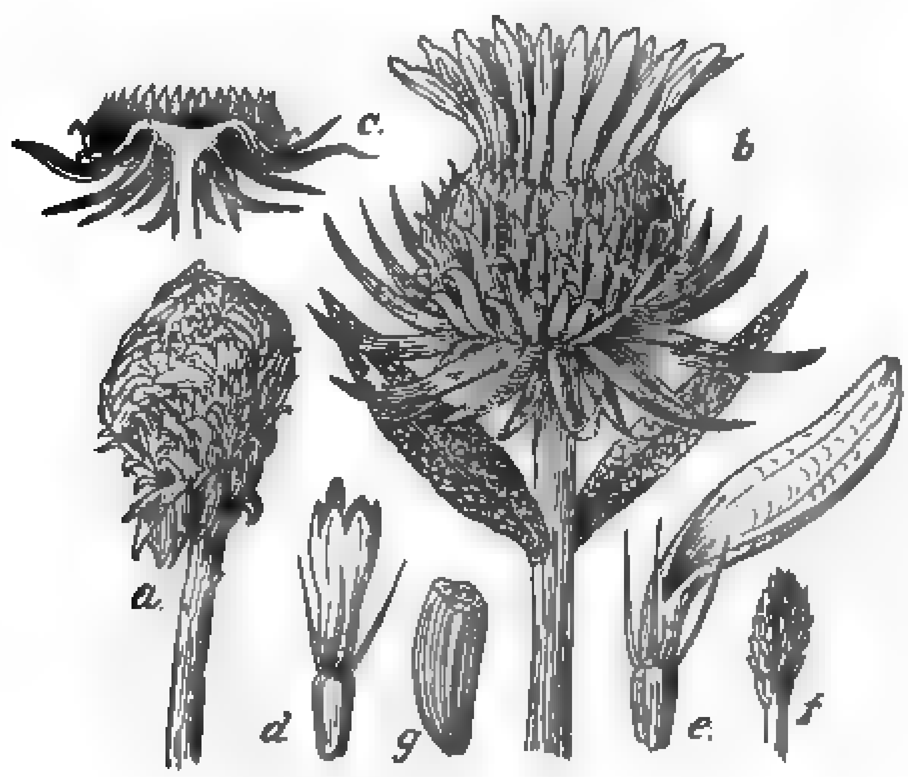


Fig. 28.

often spinosely toothed, or even laciniate-pinnatifid, pale green, smooth, finely dotted, thickish, brittle, most of them broken off from the stems and loose in the packages; there should not be more than 10 per cent by weight of stems or foreign matter; heads many-flowered, subglobular or somewhat conical; the involucre hemispherical, about ten mm. broad, composed of numerous imbricated spreading scales; ray florets yellow, ligulate, pistillate; disc-florets yellow, tubular, perfect; pappus consisting of two or three awns of the length of the disc-florets; odor, balsamic; taste pungently aromatic and bitter.

In the cut, representing *G. rob.*, *a* shows a dry flower-head, as in

trade; *b*, same soaked in water; *c*, section of receptacle; *d*, disc-floret, enlarged; *e*, ray-floret; *f*, stigma, enlarged; *g*, fruit, enlarged; *G. squarr.*, resembles *G. rob.*, but is smaller and the ray-florets are sometimes wanting. The name "squarrosa" refers to the recurved points of the scales covering the flowerheads, but this peculiarity is present in both varieties.—**C.** Resin and volatile oil.—**U.** Employed in various affections of the organs of respiration, asthma, pertussis, bronchitis, etc.; it also is said to be diuretic and useful in catarrh of the bladder. Dose: 1 to 5 grams in fluid extract.

Solidago

N. Golden Rod.—**O.** Leaves and flowering tops of *Solidago odora; Compositæ.*—**H.** North America.—**D.** Leaves three to five cm. long, entire, sessile, smooth, lanceolate, acute, pellucid-punctate; flowerheads numerous, small, in one-sided curved racemes; florets yellow, with bristly pappus; odor and taste aromatic, sweet, re-

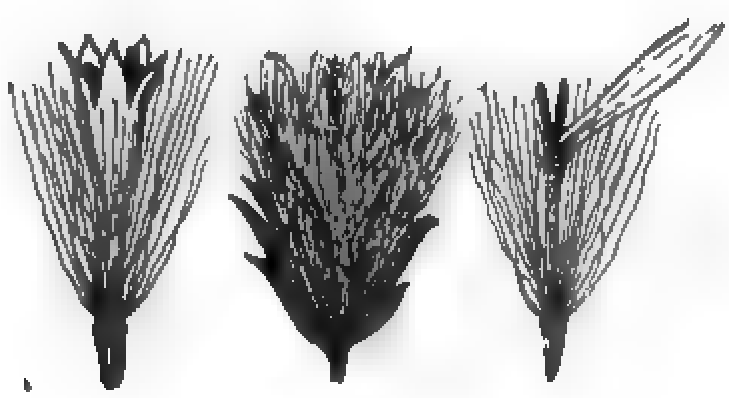


Fig. 29.

minding of anise.—**C.** Volatile oil.—**U.** Slightly stimulant and carminative; copious draughts of warm infusion produce diaphoresis, mainly on account of the warm water taken. Dose: 2 to 5 grams, best given in the form of infusion.

Tanacetum

N. Tansy.—**O.** Leaves and tops of *Tanacetum vulgare; Compositæ.* Several pharmacopoeias prescribed the use of the flowers only.—**H.** Northern hemisphere; cultivated.—**D.** Leaves about fifteen cm. long; bipinnatifid, the segments oblong, obtuse, serrate or incised, smooth, dark-green and glandular; flowerheads corymbose,

with an imbricated involucre, a convex, naked receptacle and numerous yellow tubular florets; odor, strong, camphoraceous; taste, acrid, bitter.—**C.** Volatile oil and a bitter principle tanacetin.—**U.** Emmenagogue, to restore suppressed menstruation, and sometimes for the purpose of procuring abortion. It is seldom, if ever, successful in producing the latter effect, unless the dose is so large that it produces fatal intestinal inflammations. It also

Fig. 30.

possesses anthelmintic properties. Dose: 2 to 5 grams, best as fluid extract or infusion; of the oil, one to three drops.

GENTIANACEÆ.—*Smooth herbs, with a colorless bitter juice; opposite, sessile, entire and simple leaves without stipules; solitary or cymose flowers, regular; calyx persistent; corolla mostly withering-persistent; lobes of corolla convolute in bud; stamens as many as*

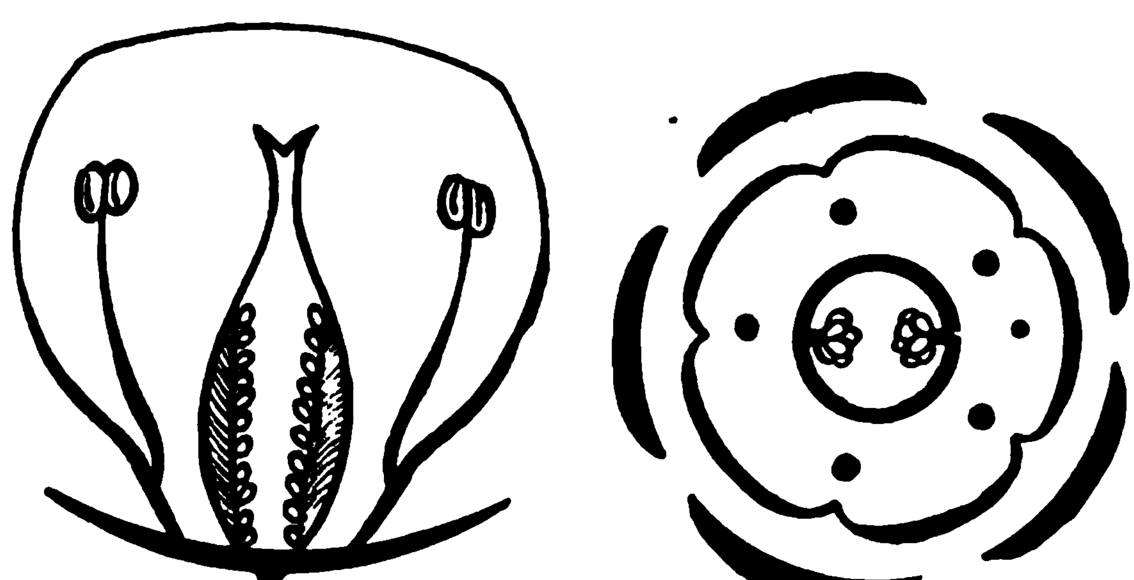


Fig. 31.

the lobes of the corolla and inserted on its tube: one-celled ovary with two parietal placentæ or nearly the whole inner face of the ovary ovuliferous; the fruit usually a two-valved septicidal and many-seeded capsule; seed anatropous with a minute embryo in fleshy albumen.

Two nectaries on each petal.................................. **Chirata.**

Chirata

N. Chirata, Chiretta.—**O.** The entire plant, **Swertia Chirata;** *Gentianaceæ.*—**H.** East India.—**D.** Chirata comes in bundles about seventy-five cm. in length, of the shape shown in Fig. 32. The root is nearly simple, about seven cm. long; stem branched, nearly one meter long, slightly quadrangular above, containing a narrow

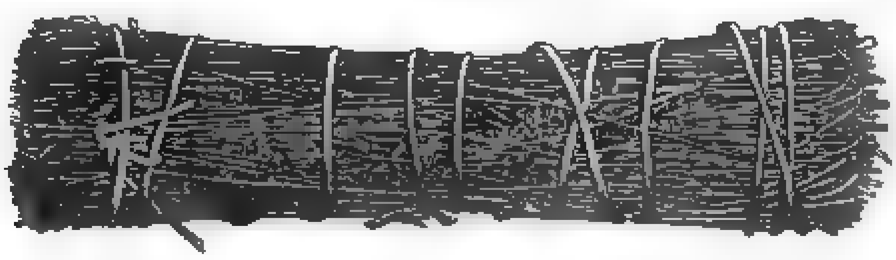


Fig. 32.

wood circle and a large yellowish pith; leaves opposite, sessile, ovate, entire, five-nerved; flowers, numerous, small, with four-lobed calyx and corolla; with two nectaries on each petal. The whole plant smooth, pale brown, inodorous and intensely bitter.—**C.** Ophelic acid, a peculiar bitter principle, chiratin, etc.—**U.** Bitter tonic and febrifuge. Dose: 2 to 5 grams, best given in the form of infusion or fluid extract.

Chirata should be freed from the coarser woody stems, which contain little of the bitter constituents.

Fig. 33

LABIATÆ.—*Chiefly herbs, with square stems; opposite aromatic leaves, mostly dotted with small glands which contain a volatile oil upon which depends the warmth and aroma of these plants; flowers axillary, chiefly in cymose clusters, these often aggregated in terminal spikes or racemes; more or less two-lipped corolla, upper lip of corolla two-lobed or sometimes entire, lower lip three-lobed; stamens inserted on tube of corolla, didynamous or diandrous; ovary deeply four-lobed, forming in fruit four little seed-like nuts or achenes,*

surrounding the base of the single style in the bottom of the persistent calyx and each filled with a single erect seed.

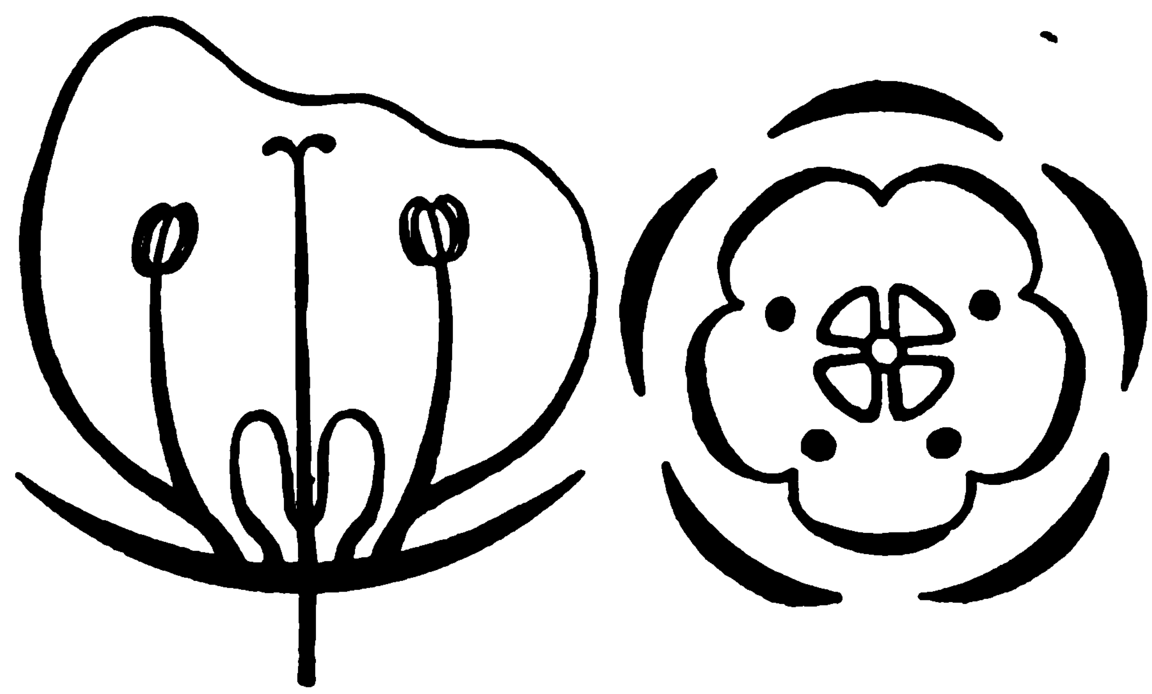


Fig. 34.

Upper lip arched; stamens 4	**Cataria.**
Corolla small, 2-lipped; stamens 2	**Hedeoma.**
Flowers in axillary whorls; stamens 2	**Lycopus.**
Flowers in corymbose clusters; stamens 4	**Majorana.**
Flowers in dense, woolly, axillary whorls; stamens 4	**Marrubium.**
Flowers in small cymes; stamens 4	**Melissa.**
Flowers in obtuse spikes; stamens 4, short	**Mentha ppt.**
Flowers in slender spikes; stamens 2	**Mentha virid.**
Corolla long, with narrow lip; stamens 2	**Monarda.**
Flowers in axillary 1-sided racemes; stamens 4	**Scutellaria.**

Cataria

N. Catnep, Catnip.—**O.** Leaves and tops of *Nepeta Cataria; Labiatæ.*—**H.** Northern hemisphere.—**D.** Stem branched, downy gray;

Fig. 35.

with petiolate, heart-shaped, oblong, deeply crenate leaves, with the under side whitish-downy. Cymose axillary clusters, dense and many-flowered, forming interrupted spikes or racemes; flowers

with whitish corolla, with four stamens ascending under the upper lip, the two lower stamens being shorter. Odor mint-like, taste bitterish and aromatic.—**C.** Volatile oil, bitter extractive, etc.—**U.** Stimulant and tonic; stomachic; but most frequently used as a remedy for flatulent colic of infants. Dose. 2 to 5 grams in infusion or fluid extract.

Hedeoma

N. American Pennyroyal.—**O.** Leaves and tops of *Hedeoma Pulegioides; Labiatæ.*—**H.** North America.—**D.** Branching, hairy, roundish-quadrangular stem; leaves opposite, short petioled, oblong-ovate, somewhat serrate, about twelve mm. long; flowers in small axillary cymules, with a tubular bilabiate five-toothed calyx,

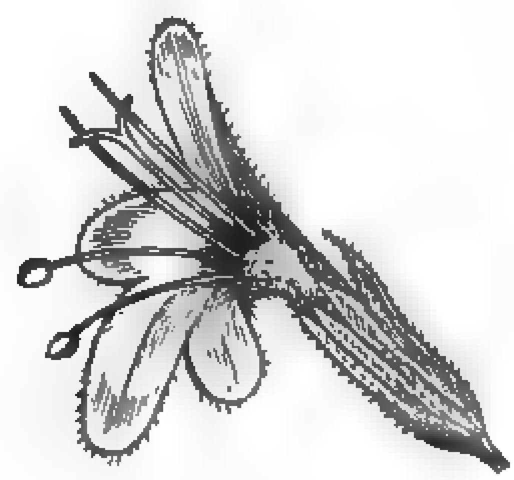


Fig. 36.

and a pale blue, spotted, bilabiate corolla, containing two fertile and two sterile stamens. Odor strong and mint-like; taste pungent, aromatic.—**C.** Volatile oil.—**U.** Stimulant, carminative and emmenagogue. Dose: 1 to 5 grams in infusion.

The fresh herb hung in rooms is much used to drive away mosquitos, and a spirit made by dissolving the oil in alcohol is used for the same purpose.

Lycopus

N. Bugle, Bugleweed.—**O.** Tops of *Lycopus Virginicus; Labiatæ.*—**H.** North America.—**D.** Stem obtusely quadrangular, with slender runners; leaves about five cm. long, short-petioled, elliptic-lanceolate, toothed above, smooth; flowers in axillary clusters, small; calyx bluntly four-toothed; corolla purplish and four-

lobed; the right hand figure shows the mouth of the corolla with the stigma and two fertile stamens; the odor resembles that of mint; the taste is bitter.—**C.** A crystallizable glucoside and tannin.—**U.** Said to be astringent and sedative, and has been recom-

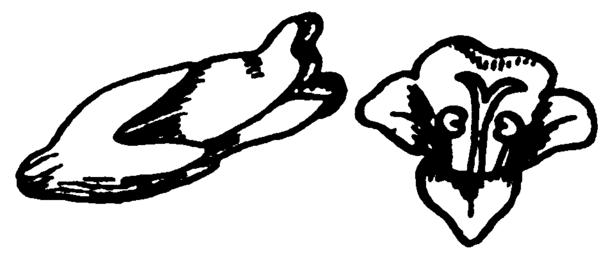


Fig. 37.

mended to reduce the force of the pulse and allay cough, and to arrest hemorrhage from the lungs. Dose: 5 to 10 grams, preferably in the form of infusion or fluid extract.

Majorana

N. Marjoram.—**O.** Tops of *Origanum Majorana* and *O. vulgare; Labiatæ.*—**H.** Asia Minor and Southern Europe; cultivated in U. S. **D.** *O. Majorana* has the stem branched; leaves about fifteen mm. long, sessile, spatulate or obovate, entire, grayish-green and hairy; flowers in clusters; calyx two-lipped; corolla whitish, obscurely

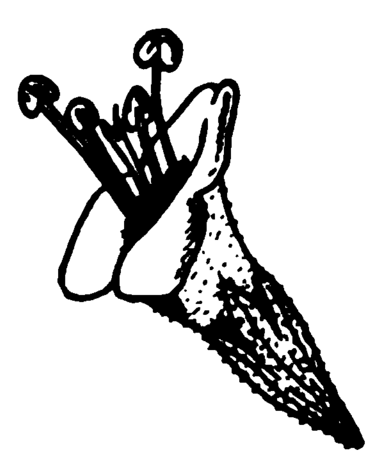


Fig. 38.

two-lipped; stamens, four, exserted and didynamous; taste pungent, odor aromatic.—**C.** Volatile oil.—**U.** Stimulant, carminative and emmenagogue. Dose: 1 to 5 grams in infusion or fluid extract.

O. vulg., a flower of which is figured, is also called Wild Marjoram, or Origanum, while *O. marj.* is known as Sweet Marjoram. The latter is the better known because it is used by cooks as a condiment.

Marrubium

N. Hoarhound.—**O.** Leaves and flowering tops of *Marrubium vulgare; Labiatæ.*—**H.** Northern hemisphere; cultivated.—**D.** Branches quadrangular; white, densely downy stems; leaves opposite, petiolate, roundish-ovate, about twenty-five mm. long,

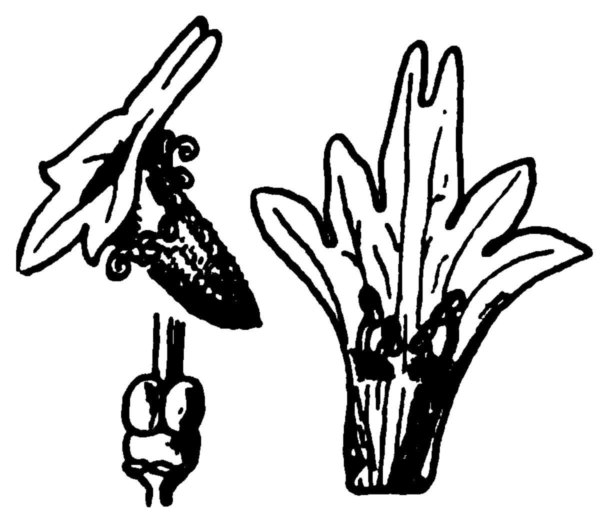


Fig. 39.

obtuse, coarsely crenate, strongly wrinkled, downy above, white hairy beneath, flowers in dense, axillary, woolly whorls; with a stiffly ten-toothed calyx, whitish, bilabiate corolla and four included stamens; odor aromatic and taste bitter.—**C.** A bitter principle Marrubiin, volatile oil, etc.—**U.** Bitter tonic and stomachic, in dyspepsia and in atonic conditions of the alimentary tract. Dose: 5 to 10 grams in infusion or in fluid extract.

Melissa

N. Melissa, Balm.—**O.** Leaves and tops of *Melissa officinalis; Labiatæ.*—**H.** Asia Minor, Southern Europe; naturalized in U.

Fig. 40.

S.—**D.** Stem branched, quadrangular, pubescent; leaves about five cm. long, petiolate, ovate, obtuse, somewhat hairy and gland-

ular, rounded or subcordate at the base, with margin crenate; flowers in about four-flowered cymules; calyx tubular, bell-shaped, five toothed; corolla whitish or purplish, bilabiate; stamens four, didynamous; odor fragrant and aromatic; taste astringent and bitterish.—**C.** Volatile oil, tannin and a bitter principle.—**U.** Carminative, diaphoretic and emmenagogue. Dose: 1 to 5 grams in infusion.

Mentha Piperita

N. Peppermint.—**O.** Leaves and flowering tops of *Mentha piperita; Labiatæ*.—**H.** Asia, Europe and North America.—**D.** Stems and branches quadrangular, often purplish; leaves about five cm. long, petiolate, ovate-lanceolate, acute, glandular and nearly

Fig. 41.

smooth, with margin sharply serrate; flowers in terminal conical obtuse spikes; calyx tubular, five-toothed, often purplish; corolla four-lobed, purplish, stamens four, short, inserted on corolla; odor aromatic and taste pungent and cooling.—**C.** Volatile oil, which contains menthol.—**U.** Carminative and nervine. Dose: 1 to 5 grams in infusion.

Mentha Viridis

N. Spearmint.—**O.** Leaves and tops of *Mentha viridis; Labiatæ*.—**H.** Europe and North America.—**D.** Stems and branches quadrangular and usually light-green; leaves about five cm. long, subsessile, oblong or ovate-lanceolate, acute, glandular and nearly

smooth, with margin unequally serrate; flowers in slender acute terminal spikes; calyx tubular, sharply five-toothed; corolla four-lobed, light purplish; stamens four, rather long; odor aromatic

Fig. 42.

and taste pungent.—**C.** Volatile oil.—**U.** Carminative and nervine. Dose: 1 to 5 grams in infusion.

Monarda

N. Horsemint.—**O.** Leaves and tops of *Monarda punctata; Labiatæ*.—**H.** United States, New York to Minnesota, south to Florida and Texas.—**D.** Stem nearly simple, minutely downy; leaves about

Fig. 43

five cm. long, petioled, lanceolate, acute, glandular, nearly smooth with margin sparsely serrate; flowers in whorls, with sessile, yel-

low and purplish bracts; calyx tubular, downy, five-toothed; corolla two-lipped, yellowish with purplish spots on upper lip; stamens two; odor aromatic and taste pungent and bitterish.—**C.** Volatile oil.—**U.** Carminative, diaphoretic, emmenagogue. Dose: 1 to 5 grams in infusion.

Scutellaria

N. Scullcap, Skullcap.—**O.** Leaves and tops of *Scutellaria lateriflora; Labiatæ.*—**H.** North America, west to Alabama and New Mexico.—**D.** Stem and branches quadrangular, smooth; leaves about five cm. long, petiolate, ovate-lanceolate or ovate-oblong, with margin serrate; flowers in axillary, one-sided racemes; calyx two-lipped; corolla two-lipped, pale-blue; stamens four, didy-

Fig. 44.

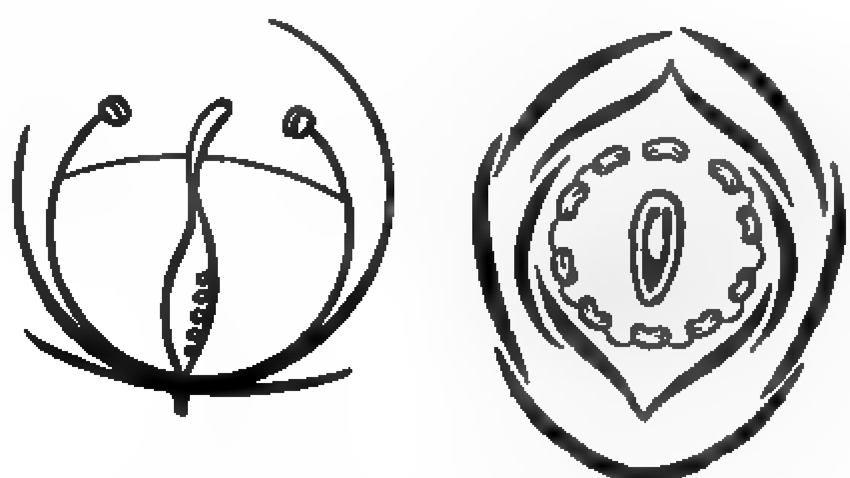


Fig. 45.

namous; odor slight and taste bitterish.—**C.** Bitter principle.—**U.** Tonic. Dose: 1 to 5 grams in infusion.

LEGUMINOSÆ.—*Plants with papilionaceous or sometimes regular flowers; stamens ten (rarely five, and sometimes many), monadelphous, diadelphous, rarely distinct; pistil free, single and simple, becoming a legume in fruit; seeds mostly without albumen; leaves alternate, with stipules, usually compound. (Fig. 45.)*

Leaves usually absent, stamens monadelphous.................... **Scoparius**

Scoparius

N. Broom.—**O.** Tops of *Cytisus Scoparius; Leguminosæ.*—**H.** Western Asia, Western and Southern Europe and naturalized in parts of America.—**D.** Stems thin, flexible, pentangular, smooth, tough, dark green and usually free of leaves; leaves, if present, small, trifoliate, leaflets obovate-oblong and entire; inflorescence racemose, but flowers often broken off, leaving the stems bare;

corolla, yellow; stamens ten, monadelphous, odor peculiar and taste disagreeably bitter.—**C.** Volatile oil, sparteine, scoparin.—**U.** Diuretic and hydragogue cathartic, of value for re-

Fig. 46.

moval of effusions in chronic dropsies. Dose: 2 to 5 grams in fluid extract or infusion.

LOBELIACEÆ.—*Herbs with acrid milky juice; leaves alternate; flowers scattered; corolla irregular, monopetalous, five-lobed; sta-*

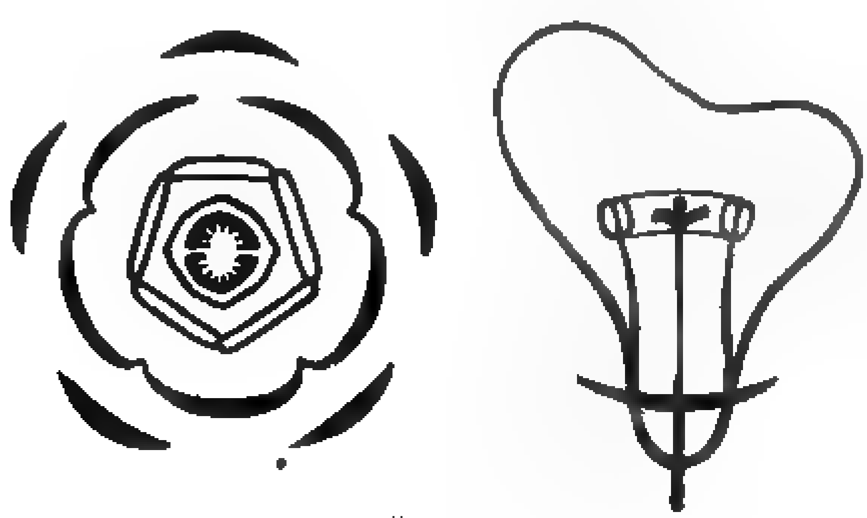


Fig. 47

mens five, free from the corolla, united into tube commonly by their filaments and always by their anthers.

Leaves alternate; stamens united into a tube....................**Lobelia**

Lobelia

N. Lobelia, Indian Tobacco.—**O.** Leaves and tops of *Lobelia inflata* collected after a portion of the capsules have become inflated; *Lobeliaceæ.*—**H.** North America.—**D.** Stem erect, with hairy branches terminating in long racemes of pale-blue flowers; leaves about five cm. long, petiolate, ovate or oblong, pubescent, pale green, with margin irregularly toothed, gradually diminishing

into leaf-like sessile bracts; calyx adherent, five-toothed, becoming inflated in fruit; corolla split down on upper side, bilabiate,

Fig. 48.

the upper lip consisting of two rather erect lobes, the other lip spreading and 3-cleft; stamens five, united into a tube; fruit an

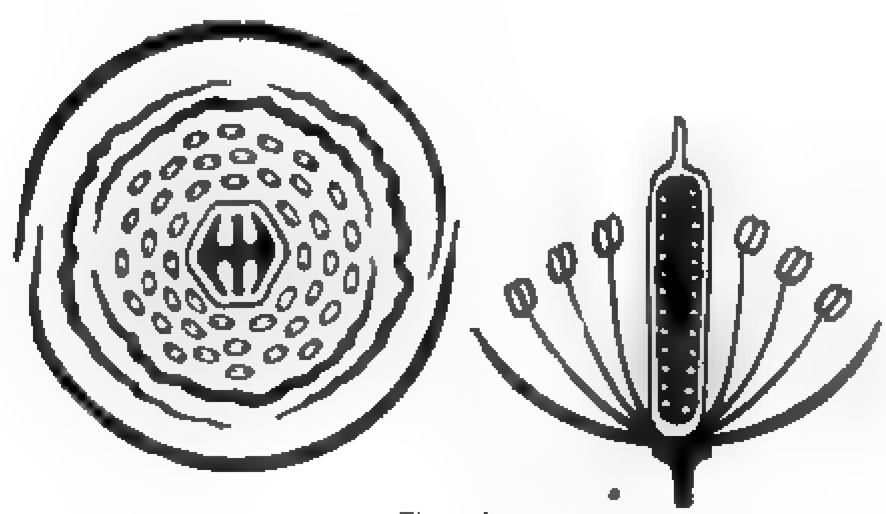


Fig. 49.

inflated pod, inferior; odor slight, irritating, and taste at first mild, afterwards acrid and burning.—C. Lobeline, lobelic acid,

etc.—**U.** Sialagogue, expectorant, emetic, narcotic and purgative; in large doses powerfully depressant. Valuable in asthma. Dose: As an emetic, 0.5 to 1.5 grams, but its use is dangerous; as an expectorant in much smaller doses.

PAPAVERACEÆ.—*Herbs with milky or colored juice; flowers regular, with parts in twos or fours; sepals two (rarely three), fugacious, falling off when the flower expands; petals four to twelve; stamens polyandrous, rarely as few as sixteen, distinct, hypogenous; ovary one-celled, with two or more parietal placentæ; fruit a dry one-celled pod or capsule. (Fig. 49.)*

Flowers in long-peduncled umbels; capsule linear..............Chelidonium

Chelidonium

N. Chelidonium, Celandine.—**O.** The entire plant *Chelidonium majus; Papaveraceæ.*—**H.** Europe; naturalized in North America.—**D.** Root, several-headed, branching, reddish-brown; stem about fifty cm. high, hairy, light-green; leaves about fifteen cm.

Fig. 50.

long, thin, petiolate, the upper ones smaller and sessile, obtuse, with margin coarsely crenate or incised and the terminal ones often three-lobed; flowers in small, long-peduncled umbels; sepals two; petals four, yellow; capsule linear, one-celled and many-seeded; odor, when fresh, disagreeable and taste acrid.—**C.** The fresh plant contains a saffron-colored milk-juice. Chelidonine, chelerythrine, chelidonic acid, etc.—**U.** Diuretic and cathartic. Dose: 1 to 5 grams in fluid extract.

RANUNCULACEÆ.—*Herbs, or some woody plants, with a colorless and usually acrid juice; flowers regular or irregular, polypetalous or apetalous, with the calyx often colored like a corolla, hypogenous; sepals three to fifteen; petals three to fifteen or wanting; stamens numerous, indefinite, rarely few; pistils many or few, rarely single; sepals, petals, stamens and pistils all distinct and unconnected; fruits, dry pods, achenes or berries.*

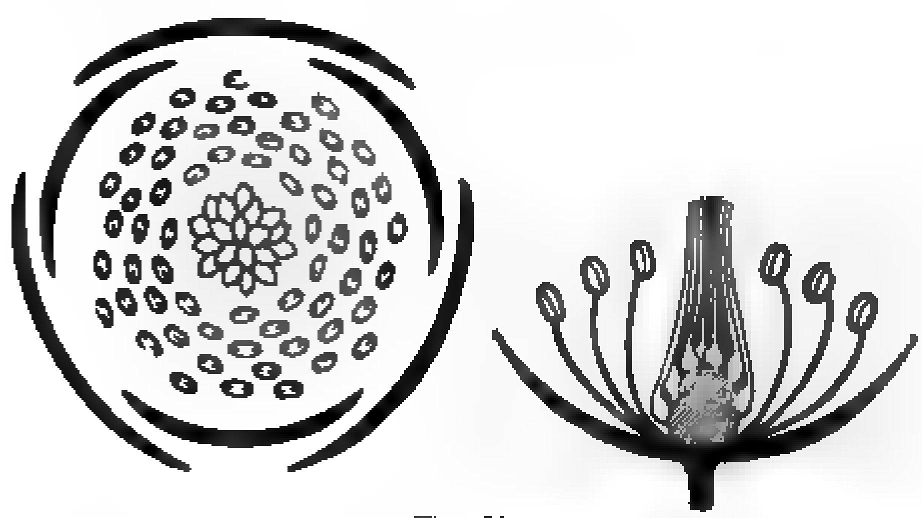


Fig. 51.

Rhizomes thin, filiform, golden-yellow .... **Coptis**
Cluster of leaves forming an involucre some distance below the flower .... **Pulsatilla**

Coptis

N. Goldthread.—**O.** Entire plant *Coptis trifolia; Ranunculaceæ.*—**H.** Northern continents.—**D.** Rhizome filiform or thread-like, bright golden-yellow, with very thin rootlets; leaves radical, from a scaly base, petiolate, trifoliate, the leaflets about one to two cm. long; obovate-cuneate, obscurely three-lobed, sharply toothed; shape slender, naked, one-flowered; calyx petal-like,

deciduous; petals small; stamens fifteen to twenty-five; pistils, three to seven, on slender stalks, maturing into divergent membranaceous pods containing from four to eight seeds; inodorous and taste very bitter. The drawing shows a flower with sepals and petals removed.—**C.** Berberine and coptine.—**U.** Pow-

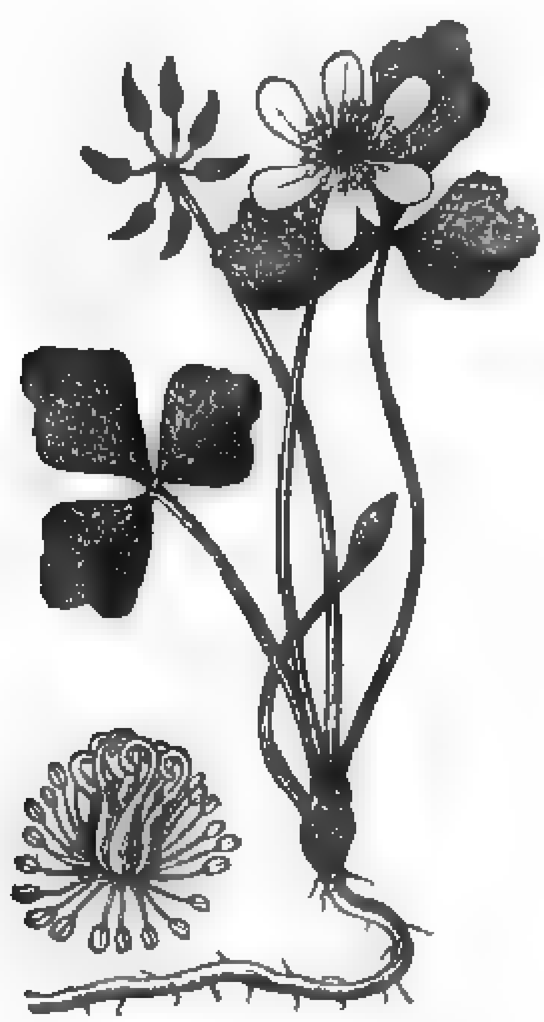


Fig. 52

erful pure bitter tonic, used as a stomachic and appetizer in dyspepsia, apepsia, want of appetite during convalescence, etc. Dose: 2 to 5 grams in fluid extract.

Pulsatilla

N. Pulsatilla, Pasque flower.—**O.** The herb of *Anemone Pulsatilla* (Pasque flower) and of *Anemone pratensis; Ranunculaceæ.*—**H.** Europe; *Anemone patens,* indigenous to Western North America, is used for the same purpose.—**D.** Leaves radical petiolate, silky-villous, twice or thrice deeply three-parted or pinnately cleft, with linear acute lobes, appearing after the flowers; flow-

ers large, purple, bell-shaped, the flowerstalk having a cluster of linear-divided leaves forming an involucre at some distance from

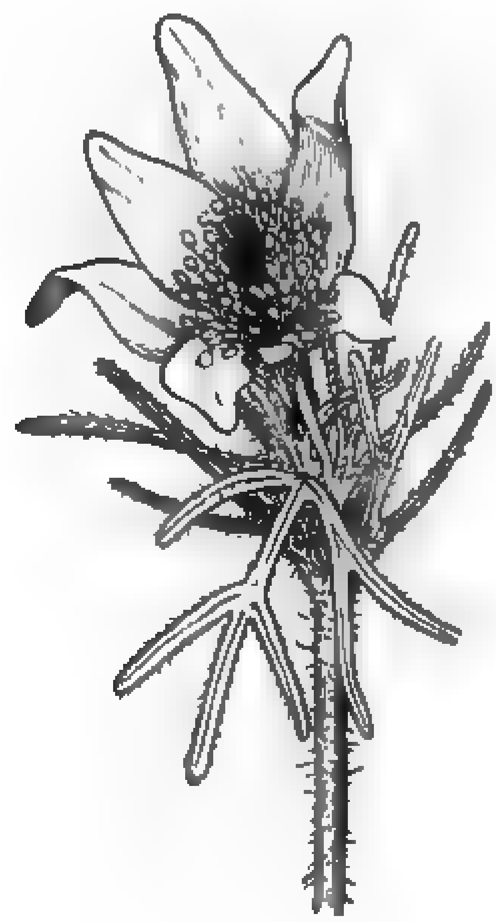


Fig. 53.

the flower and often recurved so that the flower hangs downwards; sepals petaloid; petals none; pistils numerous, forming achenes terminated by a bearded feathery style. The illustra-

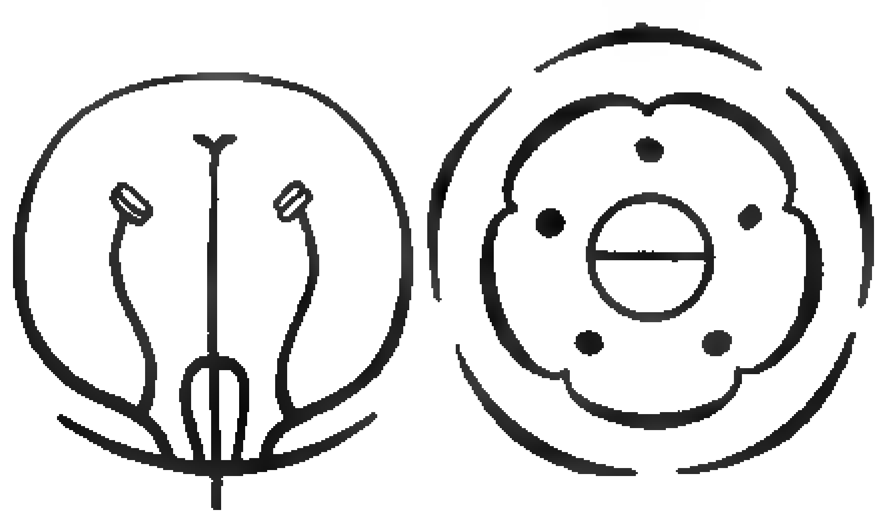


Fig. 54.

tion shows the scape and flower of the Pasque flower, Anemone Pulsatilla. The herb should be collected soon after flowering,

carefully preserved, and not kept longer than one year. The dried herb is inodorous, but has a very acrid taste.—**C.** Anemonin and anemonic acid, etc.—**U.** Diuretic, alterative, diaphoretic, expectorant; little used. Dose: 0.3 gram.

SOLANACEÆ.—*Herbs (or rarely shrubs) with colorless juice; leaves alternate; flowers regular, pentamerous, on bractless pedicels; stamens five; corolla imbricate or valvate in the bud and mostly plaited; fruit a two-celled (rarely three to five-celled) many-seeded capsule or berry. (Fig. 54.)*

Gray-green hairy leaves, irregularly lobed; flowers, or capsules within persistent calyx, often present....................**Hyoscyamus**

Hyoscyamus

N. Hyoscyamus, Henbane.—**O.** Leaves and flowering tops of *Hyoscyamus niger; Solanaceæ.* Only leaves and tops of the second year's growth should be collected; formerly only the leaves were official, and the twigs, flowers and fruits were rejected.—

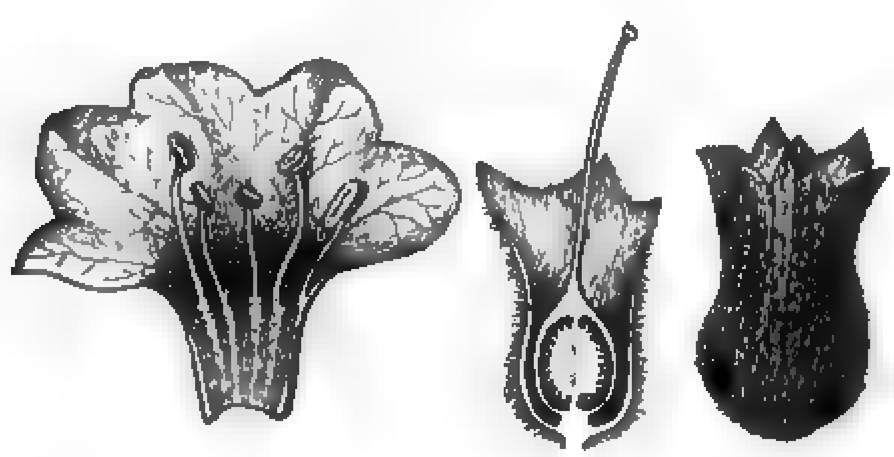


Fig. 55.

H. Europe and Asia; naturalized in North America.—**D.** Long stems cylindrical, hairy; leaf to twenty-five cm. long, ten cm. broad, with prominent midrib, grayish-green, hairy, especially on the under side; ovate or ovate-oblong, acute, sinuate-toothed, teeth large, oblong or triangular; flowers nearly sessile; calyx urn-shaped, five-toothed, persistent; corolla five-lobed, yellowish with purplish veins; occasionally the capsule, inclosed in the persistent calyx, is present, as shown in the right-hand figure; odor heavy, narcotic, and taste bitter and somewhat acrid.—**C.** Hyoscyamine, etc.; the drug should yield not less than 0.065 per cent

of mydriatic alkaloids.—**U.** Anodyne, narcotic and hypnotic; used to allay cough, spasm, asthma, etc., and often added to purgatives to prevent griping; used as a hypnotic when opium is not well tolerated. Poisonous in large doses. Dose: 0.1 to 1 gram; average dose about 0.3 gram.

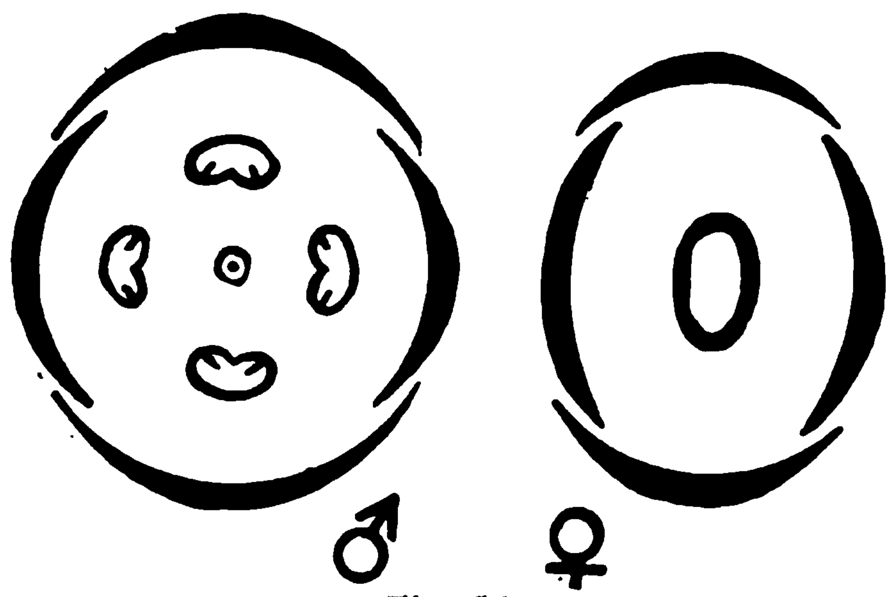


Fig. 56.

URTICACEÆ.—*Plants with stipules, and monœcious or diœcious, or rarely perfect flowers; calyx regular and free; stamens as many as the lobes of calyx and opposite them, or sometimes fewer; ovary one-celled (rarely two-celled); free from calyx; fruit one-seeded; embryo in the albumen, when there is any, its radicle pointing upward.*

Flowers consisting of single sepal inclosing pistil or capsule...... **Cannabis**

Cannabis

N. Cannabis, Indian Hemp.—**O.** Flowering tops of the female plant of *Cannabis sativa; Urticaceæ*.—**H.** Asia; collected in India.—**D.** Only the flowering tops of the female plant should be used. Branches about five to seven cm. long, with a few digitate leaves with linear-lanceolate leaflets and numerous sheathing pointed bracts, each containing two small pistillate flowers, sometimes with the nearly ripe fruit, the whole more or less agglutinated with a resinous adhesive exudation; color, brownish-green; odor peculiar, narcotic and taste slightly acrid. It should consist only of the short branches of the flowering tops of the female plants grown in East India, and from which the resin has not been removed; this article is known (see Fig. 58) in the trade as *gunjah, ganja* or *guaza*. The variety of hemp grown in Russia and

other parts of Europe, and in America, is almost destitute of resin and is generally considered to be medicinally inferior.—**C.** Resin.—**U.** Anodyne, nervine, in large doses narcotic. In Oriental countries it has been used as an intoxicant and exhilarant from times immemorial, being the "hasheesh" of those countries, and is

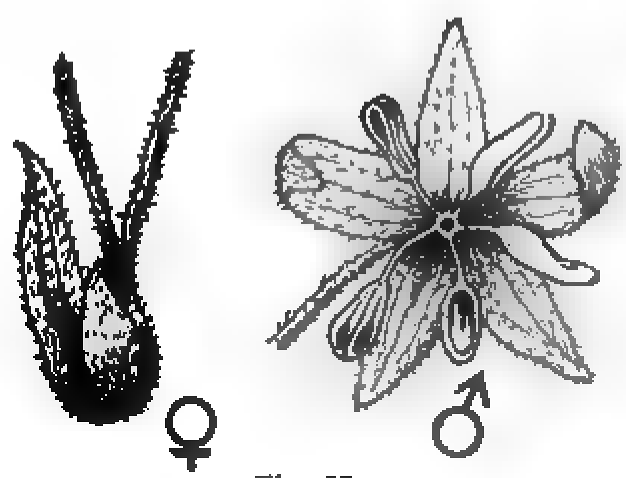


Fig. 57.

sometimes swallowed, sometimes smoked. Its effects are indicated by its East Indian names, "Increaser of Pleasure," "Exciter of Desire," etc. Used in tetanus, insanity, delirium tremens, etc. Dose: 0.1 to 0.3 gram, best in extract or fluid extract.

Bhang consists of the dried leaves and small stalks of Cannabis; it is an inferior article, excluded from use by the official description. In the Orient it is used for smoking, for making a sweetmeat called *majoon*, or an intoxicating drink by infusing *bhang* in water.

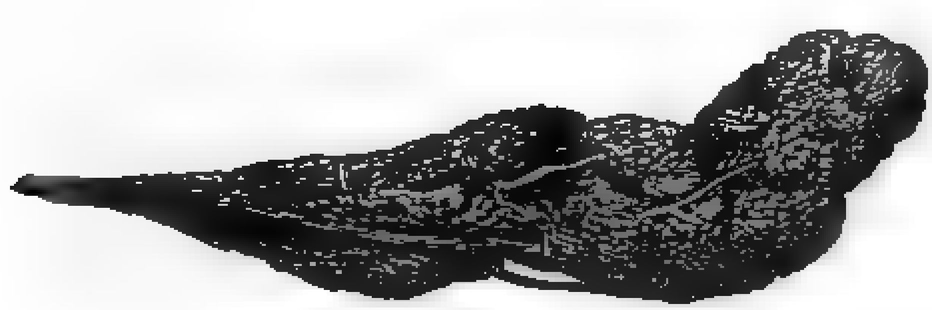


Fig. 58.

Churrus is the resin which exudes spontaneously in minute drops from the stems, leaves and tops. It is gathered by rubbing the tops with leather gloves, to which the resin adheres and from which it is afterwards scraped. It is used only in the Orient, for smoking.

Hasheesh is the Arabic name for hemp, and consists of the tops gathered some time before the seeds are ripe.

Bhang and Hasheesh or a drug much crumbled or discolored, or consisting mainly of long barren stems, should not be employed in medicine. The bare stems, without leaves or tops, are sometimes sold as Cannabis Indica; they are probably the refuse obtained when larger quantities are garbled. To sell these as Cannabis must be due to ignorance or fraud.

CRYPTOGAMOUS DRUGS

Cryptogamous plants are flowerless plants, that is, they have no stamens or pistils, but produce instead of seeds minute one-celled germinating bodies called spores, in which there is no embryo or rudimentary plantlet. They are divided into two classes, *Thallogens* or *Thallophytes,* and *Acrogens.*

Thallogens comprise the lower orders of flowerless plants in which there is no marked distinction into root, stem and leaves, the entire thallus consisting of simple cell elements without regular epidermis or fibro-vascular bundles. The thallus may have any kind of form, leaf-like, stem-like, branched, flattened or gathered into compact or globular forms, or drawn out into threads, or to single rows of cells, or even reduced to single cells. The axis of growth is indefinite and indeterminate, growth taking place chiefly peripherically and horizontally. Of the subdivisions of this group of plants the *algales, lichenales* and *fungales* furnish drugs.

Acrogens are the higher class of flowerless plants and are characterized by having a distinct and determinate axis of growth, with frequently distinct foliage. They are subdivided into two sub-classes, *Vascular Acrogens,* or *Pteridophytes,* which have wood-cells and vessels (fibro-vascular bundles), and *Cellular Acrogens,* or *Bryophytes,* composed of simple cellular tissue only, without wood or vessels. Of the vascular acrogens, *lycopodiaceæ, equisetaceæ* and *filices* furnish drugs, while the cellular acrogens (mosses, etc.,) furnish no drugs.

Many of the cryptogamous drugs are really sufficiently complete to be determined botanically, and would therefore belong

under Group IX, which we have just considered; but owing to the fact that but few pharmacists ever study the cryptogams thoroughly, we place these drugs under parts of plants not complete enough for botanical determination, and group them as follows:—

CRYPTOGAMS	Thallogens	Algales	Group 10
		Lichenales	" 11
		Fungales	" 12
	Acrogens	Lycopodiaceæ	" 13
		Equisetaceæ	" 14
		Filices	" 15

GROUP X

ALGALES.—Usually highly colored plants, aquatic or growing on damp rocks, walls, etc.; sometimes frondose, sometimes reduced to a few cells or a single cell. Fructification monœcious or diœcious, sometimes consisting of special cells of two sexes, sometimes of simple mobile spores, sometime of antheridia and sporangia, which are free or inclosed in capsules.

Thallus filiform, much branched, horny, translucent..............**Chondrus**
Thallus with large air vesicles....................................**Fucus**
Thallus round, long, stem-like...............................**Laminaria**
Mixture of several small seaweeds.........................**Corsican Moss**

Chondrus

N. Irish Moss, Carrageen.—**O.** The drug consists of the two sea-algæ, *Chondrus crispus (Sphærococcus crispus)* and *Gigartina mamillosa, Algales,* bleached and dried by exposure to the sun.—**H.** Atlantic ocean. Both algæ are gathered on the coasts of Ireland and New England.—**D.** From five to fifteen cm. long, many times two-forked, the segments varying somewhat in width, the ends either two-forked or emarginate; yellowish-white, horny and translucent; slight seaweed odor and saline mucilaginous taste. In *Ch. cr.* the spore-vessels are imbedded in the frond, as in the large figure, *a* showing a sporocarp in section and *b* showing the small bodies contained in the sporocarp; *G.m.* has the sporocarps raised on short stalks, as in *c*, or in section in *d*. The dried drug swells in water, resuming its original shape and is so represented in the

drawing. Boiled with thirty times its own weight of water it yields a mucilage which gelatinizes on cooling and does not turn blue with iodine *T. S.* (absence of starch.)—**C.** Mucilage and traces

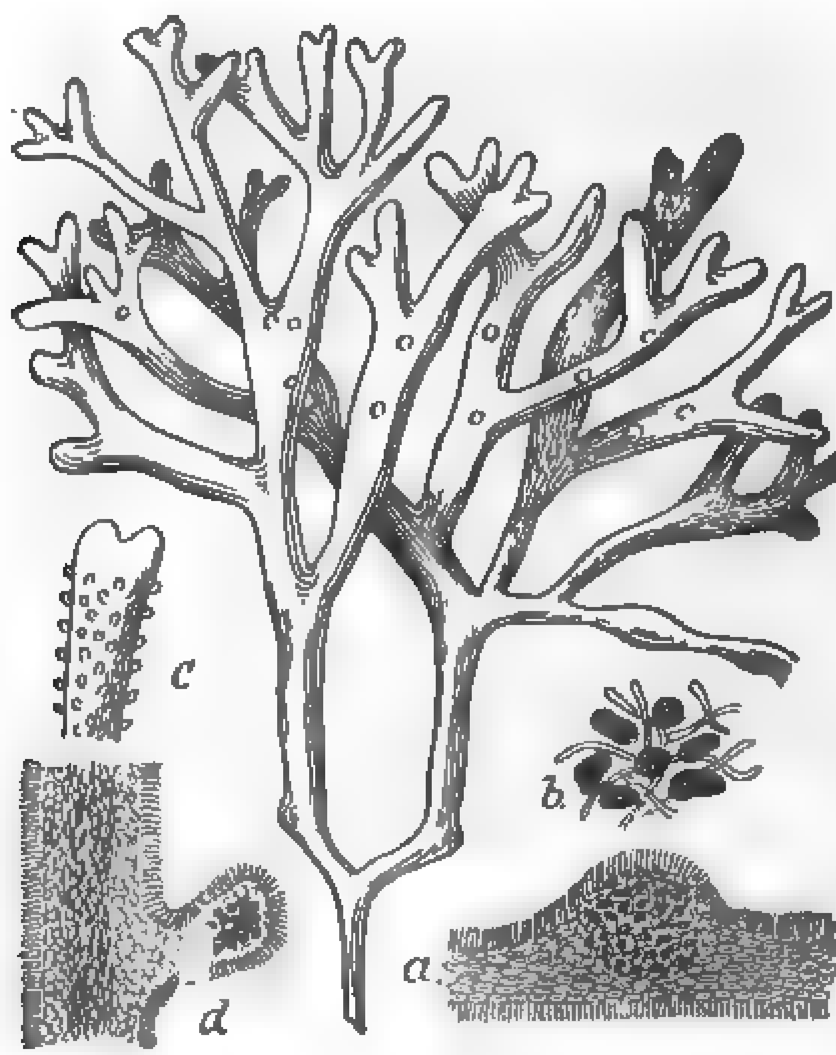


Fig. 59.

of iodine and bromine.—**U.** Demulcent and nutrient, but without the medicinal virtues usually ascribed to it. Dose: 5 to 10 grams in decoction or jelly.

Agar-Agar

Several varieties of *Fucus* or *Sphærococcus* come into trade under this title; the Ceylon variety of Agar-agar consists mainly of *Sphærococcus lichenoides;* Macassar *Agar-agar consists of Eucheuma spinosum;* Japanese Agar-agar, most frequently employed for the culture of bacteria, is made by treating several algæ *(Sphærococcus compressus, Gelidium carneum,* etc.) with boiling water, letting the resulting solution set into a jelly, which is cut into slices and dried; it occurs in translucent pieces, two feet long and as thick

as a straw, or in yellowish white masses a foot long and about an inch wide. (See Group LXXVIII.)

Fucus

N. Bladderwrack.—**O.** The whole sea-alga ***Fucus vesiculosus,*** generally mixed with ***Fucus nodosus; Algales.***—**H.** Atlantic ocean. Gathered on the shores, especially after storms, and much used

Fig. 60.

as fertilizer or to make ***kelp,*** the ash from which iodine is prepared.—**D.** The figures show both algæ, reduced to about two-thirds of the natural size; the broad frond with two air-vesicles side by side is ***F. ves.,*** and the narrow frond with single vesicles is ***F. nod.*** Fucus vesiculosus, which forms the bulk of the drug, is often up to a meter long, averaging about fifteen mm. in width; flattened, branched, and with a ridge or "midrib," the air-vesicles usually in pairs, and some of the frond-ends enlarged and nodulated

by the organs of fructification; dark-brown or blackish; odor like sea-weeds and taste saline mucilaginous. Fucus nodosus is narrow, rounded, without "midrib," and with single air-vesicles; otherwise similar to *F. ves.*—**C.** Mucilage and traces of iodine and bromine.—**U.** Alterative and tonic. Dose: About 2 grams, in decoction.

Laminaria

N. Sea-tangle.—**O.** The stem-like frond of *Laminaria digitata; Algales.*—**H.** Atlantic ocean; about the coasts of Scotland.—**D.** Stem-like, one-half to two meters long, without joints or branches, about ten to fifteen mm. thick, somewhat flattened; elastic and horny; usually covered with a thin film of salt. The

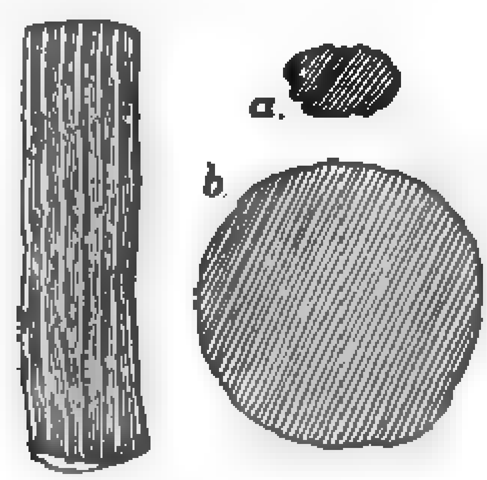


Fig. 61.

figure shows a small piece with a view of the section at *a;* when soaked in water it swells to about four times its previous diameter, as shown at *b.*—**U.** *Sea-tangle tents* and *bougies* are made by trimming down pieces of this plant to the desired sizes and diameters; these are used like sponge-tents, to dilate sinuses, etc., but mainly in gynecological practice to dilate the mouth of the womb.

Corsican Moss is a mixture of small seaweeds, of which *Gigartina Helminthocorton* is the principal one; it consists of different, delicate, filiform, repeatedly forked and intertangled algæ, varying in color from pale yellowish-brown to blue-black. *Helminthocorton* is pale brown, filiform, horny, round, branched, and striped transversely and has a salty, mucilaginous taste and seaweed odor. It is supposed to have anthelmintic properties, but Cor-

sican Moss is mainly used by the inhabitants of the countries adjoining the Mediterranean Sea for the same purposes as Irish or Iceland moss is used further north. In this country it is seldom kept in drug stores, except in neighborhoods containing French or Italian people. The drug is also known as *Helminthocorton.*

GROUP XI

LICHENALES.—These are cellular perennial acotyledons, growing on the ground, stones, barks, etc.; a perfect lichen usually consists of a *thallus* or vegetative apparatus; *apothecia* or organs of fructification, and *spermagonia* or organs of fertilization. The thallus is very variable in shape as well as in color and texture; it never has stomata and it is usually dry and leathery. It may be filamentous, crustaceous, erect, etc., and gray, white, yellow, red, brown or black in color.

It is beyond the scope of this book to refer to the fantastic theory that lichens are not a distinct group of plants, but a colony of fungi which holds a large number of algæ in captivity; practically, master fungi with slave algæ. We prefer to believe that lichens are lichens.

They are by some considered to be a subdivision of fungi, differing from ordinary fungi by having chlorophyll.

Irregularly lobed lichens, brownish-gray above and grayish-white below .... **Cetraria**
Flat lichen, brownish, with oval prominences on one side and corresponding depressions on the other side .... **Sticta**

Cetraria

N. Iceland moss.—**O.** The whole lichen *Cetraria Islandica; Lichenales.*—**H.** Northern Hemisphere.—**D.** Irregularly lobed, foliaceous lichen, about five to ten cm. long, reddish to brownish-gray above and grayish-white beneath, with small faintly marked white depressions and the margins of the lobes, which are often recurved, beset with minute teeth; little or no odor and a bitterish and mucilaginous taste. It should be freed of pine leaves, mosses and other lichens, by careful garbling. When soaked in water, it becomes soft, cartilaginous and translucent, and when

boiled with twenty-five times its own weight of water it yields a decoction which gelatinizes on cooling.—**C.** Lichenin and lichenoid, both closely analogous to starch.—**U.** Demulcent and nu-

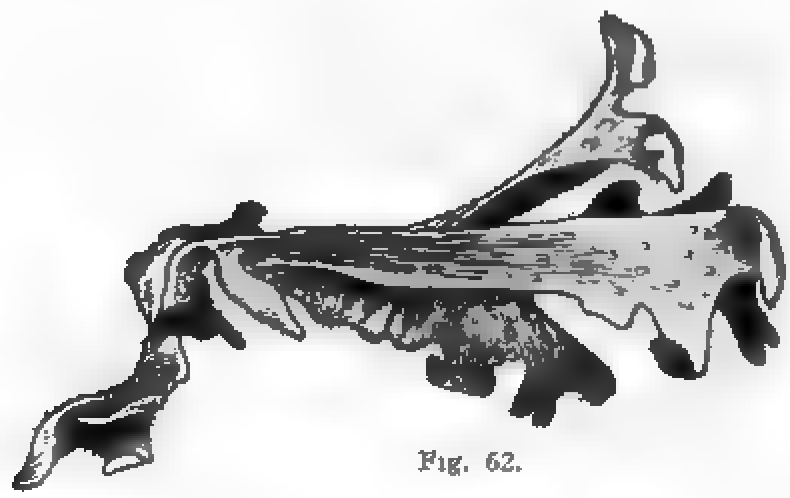


Fig. 62.

trient, supposed to exert a soothing effect on irritated bronchial mucous membranes. Dose: 5 to 10 grams in decoction or jelly. Much used as an ingredient in "pectoral teas."

Sticta

N. Lichen pulmonarius; Lungmoss.—**O.** The whole lichen

Fig 63

Sticta pulmonacea; Lichenales.—**H.** Europe.—**D.** Grows on the stems of oaks, beeches, etc, often hanging down in long shreds.

Broad leathery sheets, smooth on the upper surface with oval depressions and corresponding elevations on the other side which is rough or felted from thin rootlike fibers; odor slightly mouldy and taste bitter and mucilaginous.—**C.** It contains mucilaginous and bitter constituents, similar to those found in Iceland moss, and is used for the same purposes and in the same manner.

GROUP XII

FUNGALES.—Cellular acotyledons, generally parasitic on decaying, and sometimes on living animal and vegetable substances. They are sometimes perennial, more often ephemeral, grow best in the shade, and have no fronds, stomata or green parts. The organ of vegetation is called the *mycelium;* the organs of fructification are borne on the mycelium, and are very variable in form, and bear spores either on the exterior or interior.

Fusiform, purplish-black grains	**Ergota.**
Irregular, brown-black masses, partly membranous, partly pulverulent	**Ustilago.**
White, tough, light masses	**Agaric.**
Thin, brown, pliable, velvety sheets	**Spunk.**
Semifluid, viscid, frothy substance	**Yeast.**
White or yellowish grains	**Kefir-seed.**
Round dark brown masses, pulverulent within	**Puff-balls.**

Ergota

N. Ergot; Ergot of Rye; *Secale cornutum.*—**O.** The sclerotium of *Claviceps purpurea (Fungales),* replacing the grain of rye, *Secale cereale (Graminaceæ).*—**H.** On the inflorescence of rye, in Southern Europe. The same fungus also grows on various other grasses in all parts of the world, but the variety growing on rye is the only kind officially recognized.—**D.** Ergot consists of grain-like bodies about two to five cm. long and three to four mm. thick; the ordinary average size of fair ergot is about 2.5 cm. by 3 mm. The grains are obtusely triangular, somewhat curved, marked lengthwise by a groove on each of the three sides, the groove on the inner side of the curve being most marked and often more or less deeply fissured; the grains are thickest in the middle and taper toward the blunt ends; color externally

dark purplish, with a slight coating of bluish bloom, lighter-colored or grayish-white within; the grains break with an abrupt fracture, old and dry grains being brittle, and fresh, good ergot somewhat elastic before breaking; odor is peculiar, heavy and offensive, and taste is mawkish, fatty or disagreeable; the strong odor developed by treating ergot with solution of potassium hydroxide is due to decomposition resulting in the production of trimethylamine, which, when present in the fluid extract, renders the latter nauseating and less active.—**C.** No isolated substance constitutes the active principle of ergot; the *ergotine* of the trade is merely a solid extract; fixed oil, ecboline, ergotine, sclererythrin, *secalin*, cornutine, sclerotic and ergotic acids, etc., have been isolated, but some of these substances probably were the products of the processes employed and do not exist in the

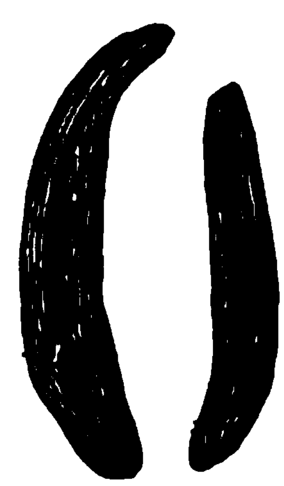


Fig. 64.

drug.—**U.** Excito-motor, causing contraction of the unstriped muscular fibers of the arterioles, sphincter muscles, uterus, etc. Parturient, ecbolic, emmenagogue, hemostatic. Dose: One to two grams up to thirty grams in urgent cases of hemorrhages, etc., to be given in powder, infusion or best in fluid extract. Cases of poisoning are reported to have been produced by ergot, and stimulants advised to be given as antidotes; such poisoning, if it does occur, is probably due to decomposition or rancidity of the drug or its preparation.

The drug is liable to be attacked by mites; to prevent this it should be carefully dried at not above fifty degrees C., and not to perfect dryness, so that it may still retain some of the elasticity of fresh ergot, then kept in closed tins or bottles into which a few drops of chloroform have been poured; the drug should be obtained fresh each season, and the old thrown away.

In the trade there are two varieties, the "German" and the "Spanish." They are not really different varieties, for ergot is often sifted or garbled after importation and the large, bold grains sold as "Spanish" and the smaller, less developed grains as "German" ergot. Spanish ergot, being the better article, is therefore to be preferred for medicinal uses; or the ergot, as imported, garbled merely to remove foreign seeds and substances, should be used without separating the large from the small grains.

Much broken, small, lean, unclean, worm-eaten, mouldy or too hard and dry ergot is totally unfit for use; the same is true of a drug having an ammoniacal odor, which is due to decomposition, or one having no smell at all.

Ustilago

N. Cornsmut.—**O.** The whole plant *Ustilago Maydis; Fungales.*—**H.** Grows on all parts of Indian corn, *Zea Mays (Gramin-*

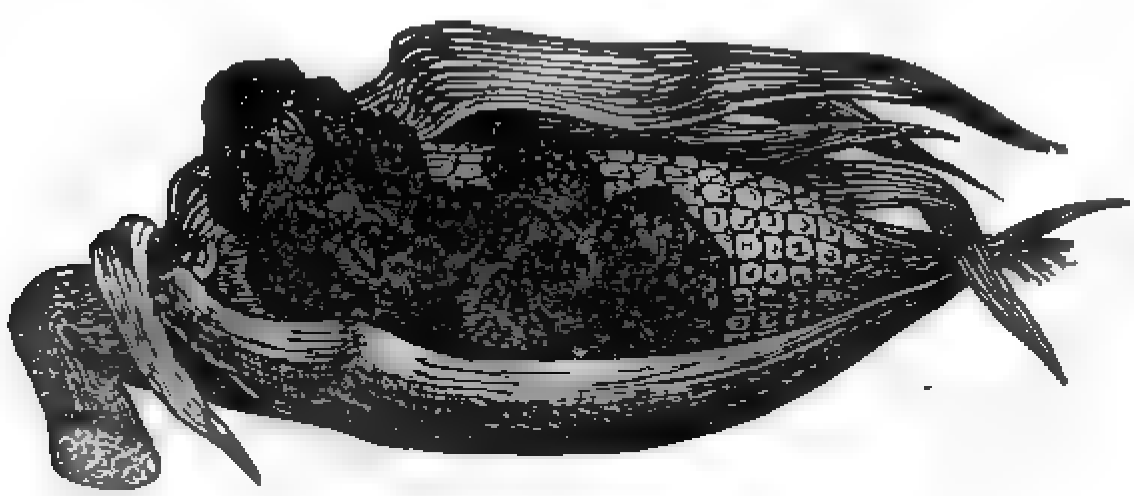


Fig. 65

aceæ), but especially on the ear.—**D.** Occurs in irregular globose masses, sometimes twelve to fifteen cm. thick, consisting of a tough external membrane, brownish-black in color, and containing a friable pulverulent mass of innumerable brownish-black spores; odor and taste peculiar and unpleasant. The drug often contains pieces of corn-cob or of corn-shucks, and is mostly a fine powder.—**C.** No active principle has been isolated; some fixed oil, a substance resembling sclerotic acid, etc.—**U.** Same as ergot, supposed by some to be preferable in midwifery practice, because it strengthens the "pains" without lengthening them; the drug is rarely used and while official in the United States Pharmaco-

poeïa 1880, was dropped from the United States Pharmacopoeia in 1890; it is at best of doubtful value. Dose: 1 to 5 grams; average dose about two grams, best in fluid extract.

Agaricus

N. Agaric; *Agaricus albus;* White agaric.—**O.** It consists of fragments of the fungus *Polyporus officinalis, Fungales.*—**H.** Europe; grows on the trunks of old larch trees.—**D.** As found in the shops it is broken up into irregular pieces, the outer rind having been removed, and is of a dirty white color, light in weight, of a close, fibrous texture, mealy on the outer surface, easily rubbed to a powder through a sieve but pulverizable only with great difficulty in a mortar; odor resembles fresh flour, and if the powder is inhaled it produces violent sneezing; taste sweetish, afterwards acrid and bitter. Agaric is liable to be attacked by an insect, and worm-eaten or dense, hard, yellowish pieces, or pieces without bitter taste, should be rejected.—**C.** Agaricin and resins.—**U.** Formerly much used as a purgative, especially as an ingredient of mixtures like the *elixir ad longam vitam*, etc.; agaricin is highly esteemed as a remedy to check night-sweats. Dose of agaric as a drastic purgative, two to four grams; in night-sweats, 0.10 to 0.20 grams.

Spunk, or *Agaricus Chirurgorum,* Surgeons' Agaric, is obtained from the fungi *Polyporus igniarius* and *Polyporus fomentarius,* collected from beech trees in Sweden, Bohemia, Hungary and Switzerland; those growing on birches or oaks yield an inferior article. The outer surface of the fungus having been removed, the interior is cut into slices, which are then soaked in hot weak lye, boiled, washed, and beaten with mallets. As found in the trade it occurs in light, thin, dull yellowish-brown, soft velvety and pliable pieces; without odor or taste. Hard, uneven surgeons' agaric is useless. It is used as a mechanical hemostatic.

When used as tinder it is called *fungus igniarius;* which is the same as above, but soaked in a solution of potassium nitrate and then dried.

Yeast, or *Fermentum,* Brewers' Yeast, is the fungus *Saccharomyces cerevisiæ,* obtained as a foam when preparing beer and other

fermented malt liquors. Only the fresh yeast is used in medicine; a whitish or pale yellowish-brown viscid liquid or frothy semi-fluid showing innumerable oval cells under the microscope, single and in chains. Yeast has a disagreeable, peculiar odor and a bitter taste. It has been used internally as an antiseptic and stimulant, in typhoid conditions, various forms of dyspepsia, in diabetes, etc., and externally as a stimulant dressing in indolent ulcers. Dose: Fifteen to fifty cm. before meals.

For ordinary use, as when yeast is employed in tests, for instance the quantitative fermentation test for sugar in the urine, it is more convenient to use "compressed yeast;" this is made by separating the liquid from ordinary brewers' yeast by a centrifuge and cutting the thick pasty mass thus obtained into small cubes, which occur in the grocery trade wrapped in tinfoil.

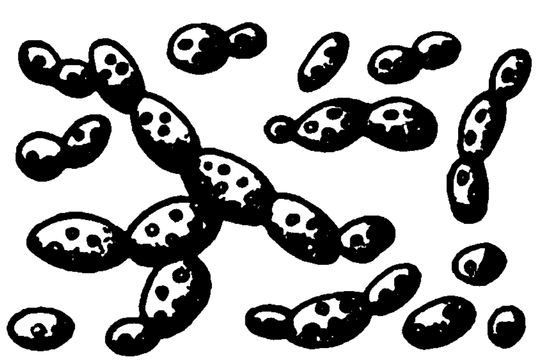


Fig. 66.

This is also the form in which yeast is now most frequently employed in the household for baking.

Kefir is a preparation made by placing a peculiar fungus mass into milk which then ferments and produces a drink which is similar to koumyss. The fungus used for the purpose is obtained from the mountainous regions of the Caucasus and consists of white or yellowish grains which are called "Kefir-seeds." The exact origin and nature of these grains are not known, but the grains contain several lower organisms or fungi of which the *Saccharomyces cerevisiæ* which constitutes brewers' yeast is one. The Kefir-seeds constitute the drug.

Puff-Ball, the whole fungus *Boletus* or *Lycoperdon cervinus*, is occasionally found in drug stores. Round pieces about the size of walnuts, consisting of an external dark-brown membrane which does not open spontaneously when ripe, and filled with a dust-like powder of dark-brown spores. Formerly employed in nervous diseases; now nearly obsolete.

GROUP XIII

Lycopodiaceæ.—Low moss-like plants, with elongated and often much branched stems covered with small lanceolate, or subulate, rarely oblong or rounded, persistent entire leaves; the one to three-celled sporangia, solitary in the axils or on the upper surfaces of the leaves along the entire stem or in terminal catkins, open when ripe into two or three valves and discharge the numerous yellow spores.

Light-yellow, very mobile powder.......................... **Lycopodium**

Lycopodium

N. Lycopodium.—**O.** The spores of *Lycopodium clavatum* and other species of club-mosses; *Lycopodiaceæ.*—**H.** Europe.—**D.** A fine, very mobile, pale yellowish powder, without odor or taste, burning with a flash when thrown in a flame; swims on water and

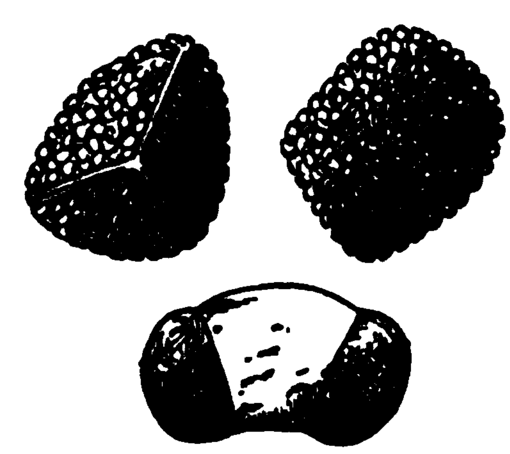


Fig. 67.

is not wet by it, unless boiled, when it sinks in the water. Under the microscope it is seen to be of the shape in the upper figure, rounded on one side, angular on the other; in the sporangia several spores adhere in a globular shape and the angular surfaces are formed by their breaking apart. Adulterations with pine-pollen, which consists of a central body with globular lobes at the two ends, as shown in the lower figure, or with other pollens, starch, fine sand, etc., are easily detected with the microscope. When burned it should not leave more than four per cent of ash.—**C.** About forty-seven per cent fixed oil.—**U.** As a protective by dusting on excoriated or chafed surfaces; in pharmacy, as a conspergative for pills, troches, plasters, suppositories, etc., to prevent adhesion to each other.

GROUP XIV

Equisetaceæ.—Rushlike, often branching plants, with jointed and mostly hollow stems, rising from running rootstocks, having denticulated sheaths at the joints and when fertile terminated by a conical or spike-like fructification composed of shield-shaped stalked scales bearing the spore-cases beneath; the spores are provided with elaters or processes which are coiled around the spores while moist and expand when dry, often suddenly so that the spores may jump some distance.

Jointed, slender stems, about 60 cm. long.................... **Equisetum**

Equisetum

N. Horse-tail; Scouring Rush.—**O.** The stems of *Equisetum arvense* and *Equisetum hyemale; Equisetaceæ.*—**H.** Europe and

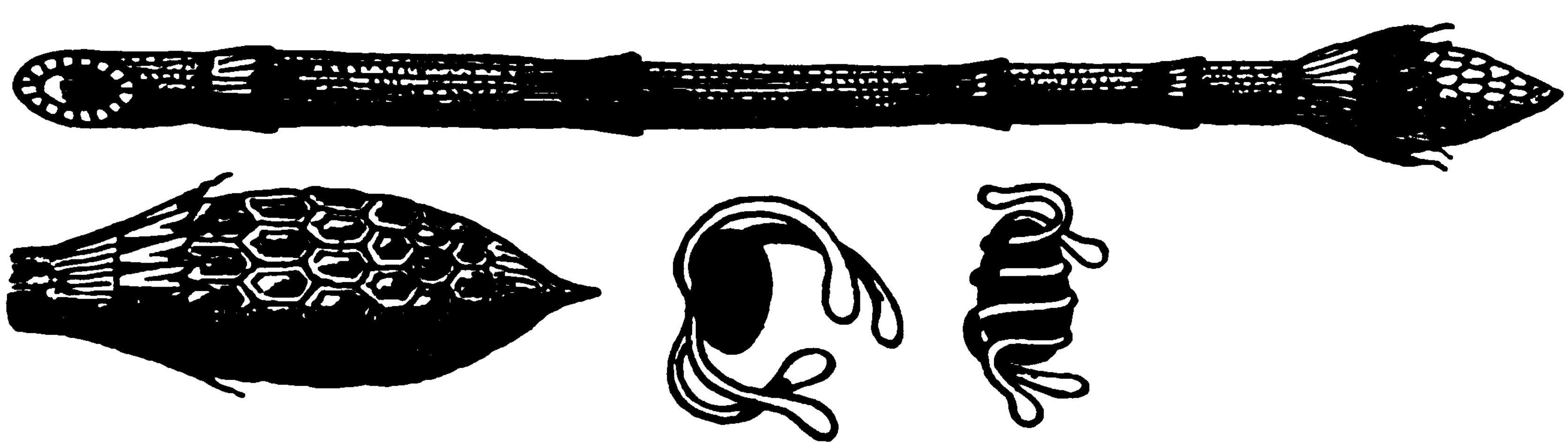


Fig. 68.

North America.—**D.** Simple, hollow, jointed, bright green, slender stems, about fifty to sixty cm. long and four to eight mm. thick; the illustration shows the end of a stem of *E. hyemale,* about natural size, and the fructification and spores enlarged.—**C.** A resin, which is the only medicinal constituent; the plant also contains large quantities of silica which renders the stem rough, and useful for scouring and polishing metallic objects.—**U.** Diuretic; in renal affections, dropsies, etc. Dose: 5 grams, in infusion, during the day.

GROUP XV

Filices.—Cryptogamous plants, generally perennial, stemless, caulescent or arborescent; fronds, borne on petioles called *stipes,* springing from the upper surface of the creeping rhizomes, or

forming regular crowns which terminate erect stems; blades leafy, circinate in the bud, simple or pinnatifid, bearing on the under surface or along the margin groups *(sori)* of sporangia which break open and discharge spores, when mature.

Large rhizome beset with the bases of stipes .... **Aspidium.**
Frond of fern with triangular leaflets and thin glossy brown stipes .... **Adiantum.**
Hard, dark-brown rhizome beset with short remnants of stipes .. **Polypodium.**
Fine, silky, glossy hairs .... **Penghawar.**

Aspidium

N. Aspidium; Filix mas; Malefern.—**O.** The rhizome of *Dryopteris Filix mas* and of *Dryopteris marginalis; Filices.*—**H.** Northern temperate zone.—**D.** Malefern is a thick fleshy rhizome surrounded

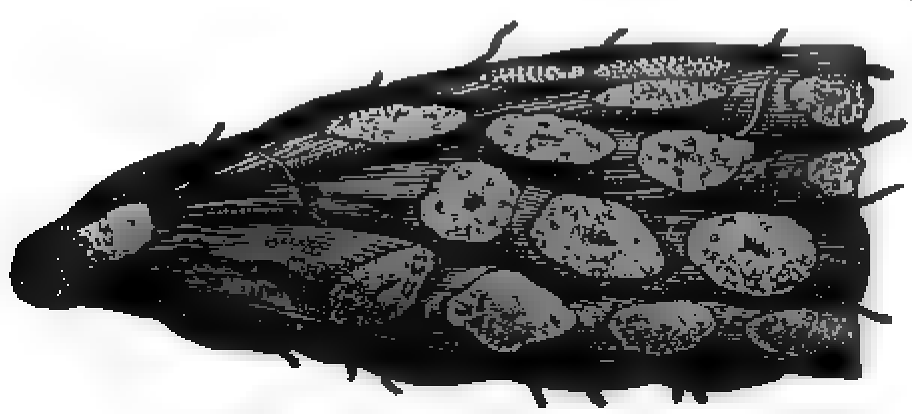


Fig. 69.

by a number of the frond-bases or stipes, as shown in the illustration. It is cylindrical, varying in length from ten to thirty cm. and in thickness about thirty to fifty mm.; but in the drug it is often cut into several pieces, and sometimes split longitudinally. The transverse section of the rhizome without the stipes is from twelve to twenty-five mm. thick, as is shown in the middle figure, and shows about six to ten fibrovascular bundles in an interrupted circle, outside of which a few scattered bundles are also found. In the trade this drug occurs frequently in small pieces, the stipes being broken from the rhizome and the latter broken into short pieces; such a frond-base is about forty to fifty mm. long and six to ten mm. thick, as shown in the left-hand figure, but sometimes these fronds are peeled as illustrated in the right-hand figure. The unpeeled rhizome and fronds are covered with a brown, scaly,

glossy epidermis, but the interiors of both rhizomes and stipes are grass-green when fresh, and they should be rejected if they have turned brown from age; when about to use the drug all the brown and chaffy parts must be cut away and only the green parts used. Malefern consists mainly of parenchyma cells, with occasional short-stalked oil glands projecting from the inner walls of the cells into the cells themselves, and the bundles consist mainly of scalariform vessels or ducts. The odor is disagreeable, the taste sweetish, astringent, nauseous and acrid.—**C.** Volatile oil, fixed oil, resin, etc., which are contained in the oleo-resin.—**U.** Tænicide. Dose of the oleo-resin: 0.5 to 1 gram.

The rhizomes of several other ferns which are used as substitutes or adulterations, may be known by the much smaller diameter of the rhizome proper, even when the attached stipes make them appear as thick as the genuine malefern.

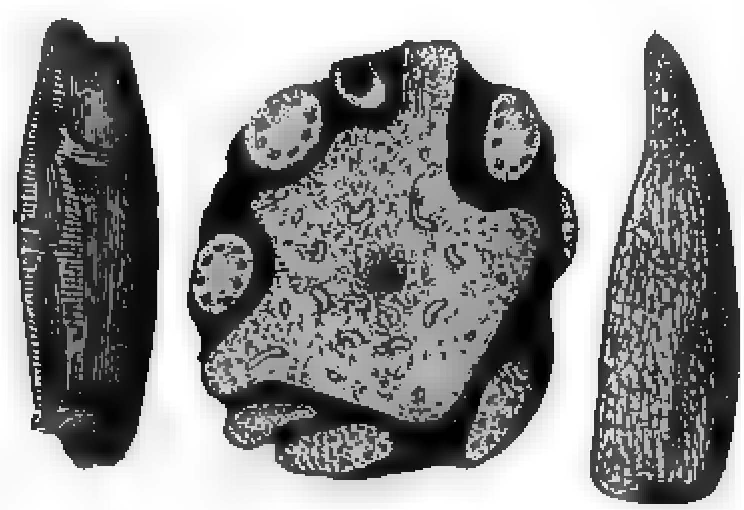


Fig. 70.

Adiantum

N. Maidenhair fern.—**O.** The fronds of *Adiantum Capillus Veneris* and *Adiantum pedatum; Filices.*—**H.** The first named is a native of Europe, the last named is indigenous.—**D.** The drug consists of the fronds of these ferns with the leaflets, as seen in natural size in the figure; the edges of the leaflets are recurved, and the sporangia are attached under this edge, as shown at *a* where the leaflet is straightened out, and at *b* where it is shown in section. The leaflets are green while the stipes or stalks are

glossy dark brown and filamentous, wherefore the name of "maidenhair" (German: Frauenhaar, Venushaar) was given to the plant. The odor is slightly aromatic and the taste mucilaginous,

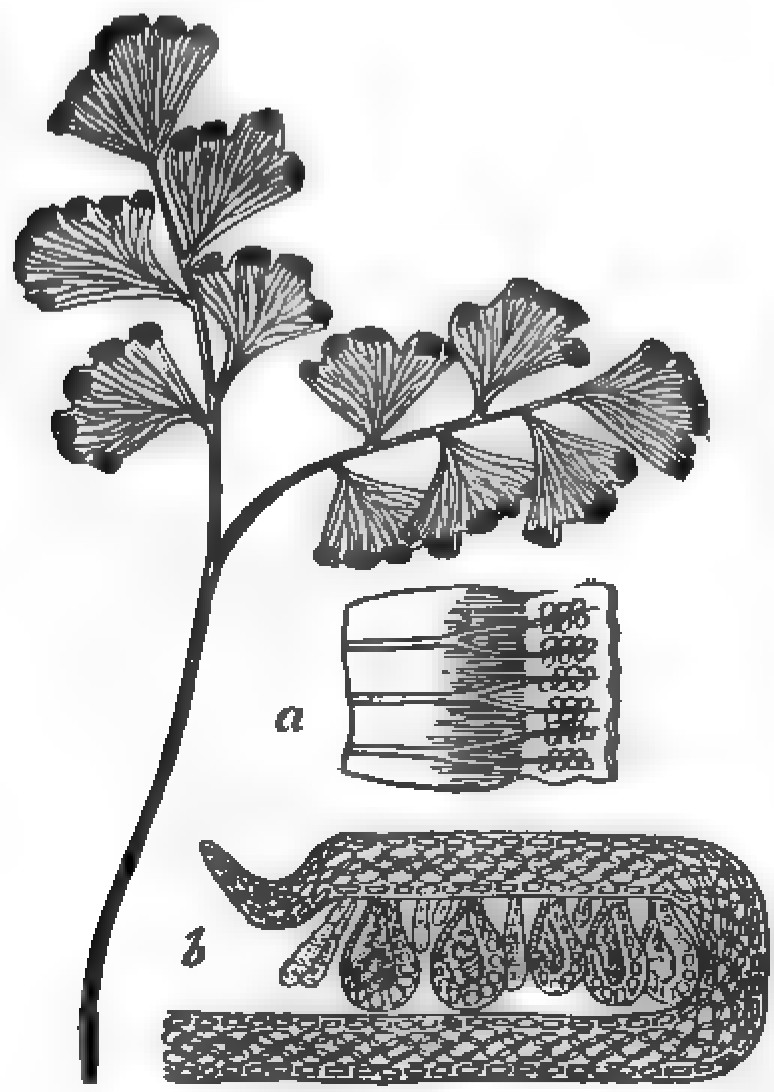


Fig. 71.

sweetish-bitter and astringent.—**C.** Mucilage, tannin and bitter principle.—**U.** Demulcent and expectorant. Dose: 3 to 5 grams in infusion or syrup.

Polypodium

N. Polypodium; Rock-brake; Brake-root.—**O.** The rhizome of *Polypodium vulgare; Filices.*—**H.** Europe and America.—**D.** The illustration shows the shape well. The somewhat contorted rhizome is of the thickness of a large quill and is beset with rather scattered short tubercles or stipe-remains; externally reddish-brown and internally green when fresh and cinnamon-colored when old. On section about ten small fibro-vascular bundles are

seen arranged in a loose circle, the predominant tissue being an amylaceous parenchyma. The taste is at first sweet, afterwards disagreeably acrid and bitter; odor like rancid oil.—**C.** Not ana-

Fig. 72.

lyzed.—**U.** Expectorant in asthma and catarrh; also said to be purgative and anthelmintic. Dose: 1 to 5 grams in infusion or syrup.

Penghawar

N. This substance is known by various names; *Pili Cibotii*, Penghawar Djambi, Cibotium, Paku-Kidang or Pulu.—**O** and **H.** It consists of the hairs from the fronds of many varieties of ferns

Fig. 73.

growing in Sumatra, Java, and other tropical islands and countries; mainly varieties of *Cibotium*, as *C. Baromez*, *C. Djambianum*, etc., all of which, as Berg conjectures, may be merely varieties of

Polypodium Baromez. Paku-Kidang is from *Alsophila lurida,* and other Javanese ferns. The hairs of *Cibotium glaucum* and other varieties of *Cibotium* come from the Sandwich Islands, and are known as Pulu or Pulu-Pulu.—**D.** Formerly the stipes, beset with hairs, came into trade, but now only the hairs are used. All of these ferns yield hairs which resemble each other closely, the drug consisting of glossy, golden-yellow or bronze-colored, curled and jointed, several or many-celled fine silky hairs which are from 1.5 to 3 cm. long, collapsed or flattened in such a way that the hairs appear to be twisted at the juncture of the separate cells; the individual cells or joints are flattened and often placed crosswise to each other owing to torsion in the partition walls, thus producing the curling; odorless and tasteless.—**C.** A little tannin, resin, etc.—**U.** These hairs have been used to make pillows and mattresses, but in medical practice they are employed as a powerful local hemostatic and styptic drug, acting probably mainly or altogether in a mechanical manner by affording support to a forming clot.

STRUCTURE OF ROOTS AND STEMS

Since a large number of drugs are roots, rhizomes, stems or parts of stems, as woods, barks, etc., it is necessary that we study the minute structure of the various modifications of the descending and ascending axes of plants.

In the lower orders of cryptogams, which we have just considered, there is little or no cell differentiation and these thallogens are without root, stem and leaf structure; in the higher cryptogams, the acrogens, such structures are apparent, but in the cellular acrogens they are still made up of simple cell-elements only, while in the vascular acrogens cell differentiation into various tissues takes place.

Comparatively few plants are unicellular, and these only of the lowest orders of cryptogams, the thallogens; but most of the thallogens, and all plants higher than these, are made up of many or innumerable cells and in the vascular acrogens and the phanerogams these cells are differentiated by changes in their shapes and in their cell walls, as already explained in the remarks devoted

to the consideration of cell structure. These various cells unite to form "tissues."

A tissue may be defined as an aggregation of many similar cells united to perform a common function, but the word ought not to be misunderstood to mean plant organs which also may have definite functions to perform, but may be composed of several tissues; thus, when we speak of seeds, roots, etc., as belonging to the "storing system of tissue," it does not mean that these organs are single tissues but that they are made up of systems of different tissues which together form the organs that act as food reservoirs.

We have already considered the nature of parenchymatous and prosenchymatous cells, the characteristics of which must be firmly fixed in the mind; aggregations of parenchymatous cells form *pa-*

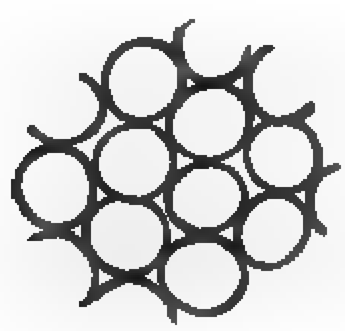


Fig. 74.

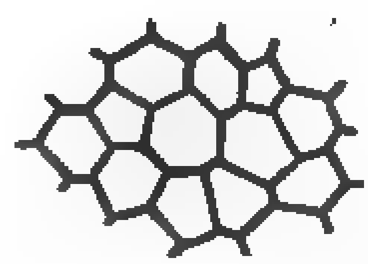


Fig. 75.

renchymatous tissue or *parenchyma,* while aggregations of prosenchymatous cells constitute *prosenchymatous tissue* or *prosenchyma.* Similarly, aggregations of collenchymatous or sclerenchymatous cells form *collenchyma* or *sclerenchyma* respectively, these names referring to the nature of the cell walls, while the words parenchyma and prosenchyma refer to the shapes of the cells. In a general way all cells and tissues are either parenchymatous or prosenchymatous, although in some of the thallogens the thallus consists of felted threads *(hyphæ),* which do not strictly belong to either of these groups but which form a distinct and peculiar kind of tissue *(pseudo-parenchyma),* which is, however, of minor interest to the pharmacognosist.

In parenchyma the cells abut against each other by broad surfaces, and as the ends of the cells are not interlaced and the cell walls are usually soft, this tissue is easily torn or broken; the cells in parenchyma are often so loosely aggregated that the cell walls are

not compressed and many of the cells retain a spherical form with many minute intercellular spaces, as in the pulpy part of some fruits, but if such cells are brought into complete contact with the adjacent cells by pressure during growth they will become more or less regularly dodecahedral or twelve-sided; such cells are preferably spoken of as polyhedral or many-sided cells. In rapidly growing parts in which the growth is more rapid in one direction, as for instance, in the longitudinal direction of many roots and stems, the individual cells also may be elongated in the direction of most rapid growth, becoming cylindrical if lateral pressure is small, as in sarsaparilla (see Fig. 74), when small triangular or irregular intercellular spaces will be seen on transverse

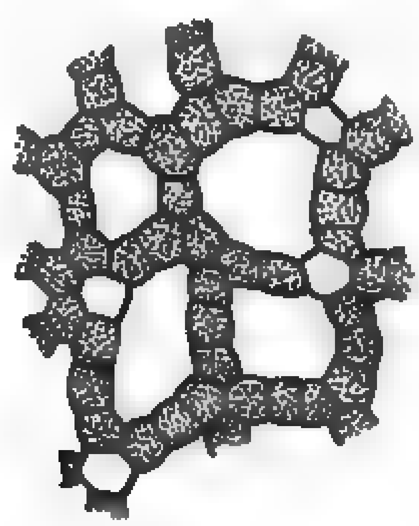


Fig. 76.

section, or these spaces may be obliterated by lateral pressure when the cells assume prismatic shapes, the hexagonally prismatic form being most common, as seen in the transverse section of the parenchyma of couch-grass, dandelion root, etc. (See Fig. 75.)

As so large a portion of all pith and other fundamental parenchyma tissue consists of cells which are compressed so as to obliterate the small intercellular spaces, so that the polyhedral forms preponderate, it is advisable to make a simple experiment to show the shapes of these cells. Fill a pint or quart bottle completely with any fluid that will readily foam, as for instance with an infusion of quillaja, or a solution of soap in water to which a little glycerin is added, and then empty it by turning it upside down so that the fluid gurgles as it runs out and the air bubbles rise up through it; a narrow necked bottle is best for the experiment, and

when the liquid has all run out the bottle will be filled with a foam consisting of bubbles, which, by mutual pressure, will assume the dodecahedral or polyhedral form of the parenchyma cells we are considering, especially in the interior of the bottle, and it is instructive to watch the various shapes assumed by the adjacent bubbles, as one after another of these bubbles burst and alter the pressure. The bubbles adjacent to the glass show the shapes of sections of these cells.

Larger intercellular spaces than those just mentioned may be seen in calamus in which the cells are arranged as shown in the drawing (Fig. 76), the shaded cells containing starch, the undotted containing oleo-resin; examples of similar intercellular spaces may be found in most aquatic plants, as in the stems and leaf-stalks of calla, water-lilies, etc., and drugs having such structure usually break with a corky or spongy fracture. In aquatic plants such large intercellular spaces are filled with air, which is also often the case in terrestrial plants having such spaces, but in the latter kind of plants these spaces sometimes contain oil or

Fig. 77.

latex (milk-juice) when, if they are nearly spherical, they are called "glands" (as in orange and lemon peels, etc.), while if they are long or tube-like, they are called "ducts;" but it must be remembered that such glands and ducts may also be formed by the absorption of cell partitions, in which case they are not intercellular spaces but true ducts. Whatever the nature or method of formation of such oil, resin, or latex ducts or spaces may be, the presence or absence of such ducts, spaces, or even large special cells, serves as a basis for group-divisions, as in Groups XVIII, XIX, XX, XXI, XXIII, and XXIV, while in any case, whether filled with air or anything else, they usually impart a characteristic appearance to the section and are therefore frequently of diagnostic value.

In prosenchyma the ends of the long cells, which are often

hardened by a deposit of lignin or sclerogen, are interlaced or spliced, as in the drawing of wood cells from sassafras root, so that this tissue is not readily torn apart or broken and it serves for mechanical support and strength. Wood cells, bast cells and most of the ducts belong to this system of tissues, and prosenchyma is found mainly in the fibro-vascular bundles.

Parts of plants which consist mainly of parenchyma are called "fleshy," while those containing mainly lignified prosenchyma are "woody."

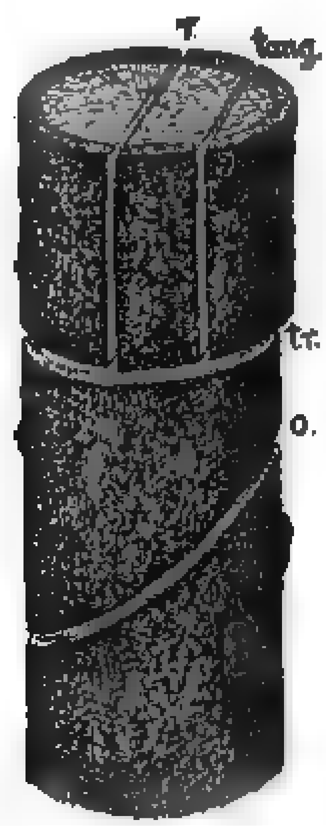


Fig. 78.

When we break the base of the petiole of a plantain leaf (from the common plantain weed, *Plantago major)* we find that while we can readily break through most of the leaf-stalk, the broken ends are held together by a number of threads in the interior of the stalk; and if we pull the lower end with the threads towards the apex along the under side of the leaf, we can pull out these threads from the veins of the leaf. These thread-like strands are the *fibro-vascular bundles,* consisting of fibers or prosenchyma cells and vessels, as the name implies.

It is rarely the case that these fibro-vascular bundles can be

pulled out as threads, for in most plants they are intimately grown together with or adherent to the surrounding tissues, so that we must make sections of the plant-organ which contains them to trace them and to study their characteristics. These sections can be made in four different directions, of which two at least are essential to a correct understanding of stem structure; a third is often of value but the fourth is seldom required.

Fig. 78 shows in what direction these sections are to be made; the *transverse* section *(tr.)* is at right angles across the axis of growth, and is by far the most useful and instructive; the *radial* section *(r.)* is often also called the *longitudinal* section and it passes along the axis of growth and along the line of a radius or a line from the center to the circumference, and it is next to the transverse section in importance, as it shows the nature of the elements of the fibro-vascular bundles, the ducts, wood fibers, etc.; the *tangential* section *(tang.)* also passes along the axis of growth, but at right angles across a radius, and it is useful mainly for the study of the medullary rays; finally, we may have occasion to make an *oblique* section *(o.)* although but little is to be learned from it and it is very rarely intentionally made, but quite frequently accidentally made of fibro-vascular bundles, especially in monocotyls, when we make sections just below the point where one of the bundles is bent outwards to go to a leaf or rootlet, and which then appears as an oval section of a bundle differing in appearance from both the transverse and longitudinal sections of the same kind of bundle.

In classifying plants or drugs we frequently use the terms mono-cotyledonous'' and ''di-cotyledonous,'' for instance in Ray's *System of Taxonomy*, in A. D. 1686:

RAY'S SYSTEM, A. D. 1686.

Flowerless Plants.

Flowering Plants { Mono-cotyledonous.
Di-cotyledonous

Divided into { Woody trees.
Herbaceous plants.

Further subdivisions based on fruits.

Also in the system used in Gray's *Manual of Botany:*

NATURAL SYSTEM, GRAY'S MANUAL.

Series.	Class.	Subclass.	Division.
Phaenogams	Di-cotyledons (Exogens)	Angiosperms	Polypetalæ.
			Gamopetalæ.
			Apetalæ.
		Gymnosperms.	
	Mono-cotyledons. (Endogens)		
Cryptogams	Acrogens	Pteridophyta.	
		Bryophyta.	
	Thallogens.	Thallophyta.	

Let us fix in our minds what these words mean and even more, what they imply; the word "mono-cotyledonous"[1] means that the embryo in the seed has only one cotyledon or seed-leaf, as in the seeds of Indian corn, colchicum, etc., but it implies much more; it implies that the plant growing from such a seed has parallel-veined leaves, flowers arranged on the numerical plan of 3, and that its axis shows "endogenous" structure." It is customary, although not strictly correct, to say or write "mono-cotyledonous structure" when we mean "endogenous structure."

The word "di-cotyledons" means that the embryo in the seed of such a plant has two cotyledons or seed-leaves as in the seeds of the peanut, almond, bean, etc., but it implies that the plant growing from such a seed has netted-veined leaves, flowers usually arranged on the numerical plan of 4 or more (usually 5), and that its axis shows "exogenous" structure. It is also customary, although not strictly correct, to speak and write of "di-cotyledonous structure" when we mean "exogenous structure;" but this careless use of the terms dates back, as shown above, to the times of Ray, in 1686, and usage has established the employment of the terms as explained.

In a transverse section of the stem or root of a vascular cryptogam or of a phanerogam it will be seen that the outer layer or layers of cells differ from the cells within. Perhaps the first and simplest change or differentiation of cells is the formation of an epidermis or cuticle, and even in thallogens in which there is no

true cell differentiation the outer cells are usually smaller and with thicker walls although otherwise like the larger interior cells. In leaves, young twigs, flowers, fruits, etc., the outer layer of cells have their outer cell wall thickened by a deposit of *cutin*, thus forming a true cuticle or epidermis, while in older stems, roots, etc., *cork* or *suber* is formed under the epidermis which latter finally disappears entirely, so that in older parts cork then forms the outermost layer. Cutin is chemically identical with cork but differs in being deposited in the cell walls of the epidermal layer only, while cork is deposited in layers which are sometimes many hundreds of cells thick.

If we make a transverse section from the young stalk of Indian corn *(Zea Mays)* which is easily obtained by planting a grain of corn and then taking the stalk for examination when it

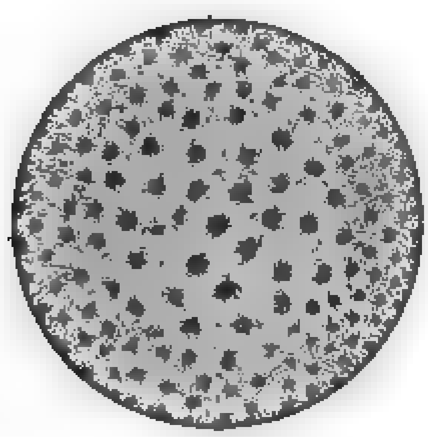


Fig. 79.

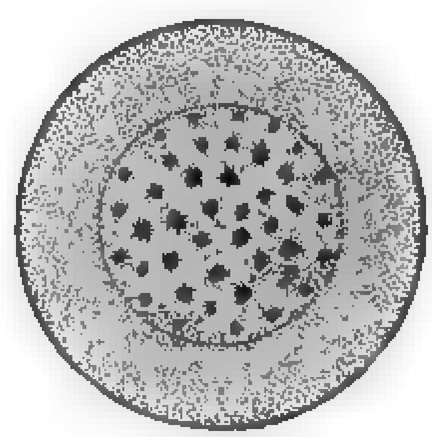


Fig 80.

is of about the thickness of a lead pencil, we will see that it appears circular, or nearly so, and is surrounded by the epidermis and that the interior consists mainly of parenchymatous tissue with irregularly scattered circular clusters of cells appearing like dots, which latter are the sections of the fibro-vascular bundles, as diagrammatically represented in Fig. 79. These dots are distributed throughout the entire thickness of the stem, as is seen in the section, but so that the outer dots are somewhat smaller than those nearer the center of the section. This section shows the most common structure of monocotyls, and the structure is called *endogenous* (or inward growing) because as the plant becomes older it increases in thickness by a formation of new fibro-vascular bundles among and between the others, and as

these are formed when the plant is larger the bundles also become larger, so that the newer and larger bundles are found mainly in the interior of the plant. In Fig. 80 we see a simple modification of this structure, for a layer of cells forming in the section a ring concentric with and some distance within the cuticle separates the parenchyma into two portions, and this ring of cells which, in the stem, forms a cylinder or tube, is called the *nucleus sheath;* within this sheath the fibro-vascular bundles are disposed, just as they are disposed in Fig. 79 throughout the entire thickness of the stem.

This type of structure, diagrammatically shown in Fig. 80 can be seen in orris root. In a drug of this kind the part outside of the nucleus sheath is sometimes spoken of as "bark" or "cortex," but this is wrong, because monocotyls have no bark.

In monocotyls the cells which do not belong to the cuticle, nucleus sheath or the fibro-vascular bundles, belong to the parenchyma, which is called the *fundamental tissue.*

Many students seem to fail to associate the drawings of transverse sections with the idea of continuity throughout the length of the axis of the plant. Suppose that some experimenter like Roentgen would discover a new kind of x-rays which would render all the parenchyma of the fundamental tissue of plants transparent or invisible while the cuticle or outer bark and fibro-vascular bundles remained visible as concrete objects, a mono-cotyledonous stem, as that of Indian corn, would then appear like a tube within which a number of threads or thin rods were arranged lengthwise, the space between being filled with the transparent medium, the fundamental tissue. Since we have no such convenient x-rays, let us substitute our imagination and fancy the fundamental tissue to be invisible; let us imagine a portion of the cuticle on the side nearest us to have been cut away so that we can look into the inside of the stem, and on looking through a suitable magnifying lens we would see the structures as shown in the lower part of the figure. If we cut across such a structure the appearance of the surface would be as is shown in the map of the section projected above the stem, in the circle in the upper part of the figure. If we were to cut off a thin slice from the end this would be a transverse section and such a section is therefore practically a map showing the manner of distribution of the dif-

ferent tissues in the stem; but the relation of this transverse section (or map) to the real continuity of the tissues themselves, as shown in the figure, should always be mentally associated with the examination of every section.

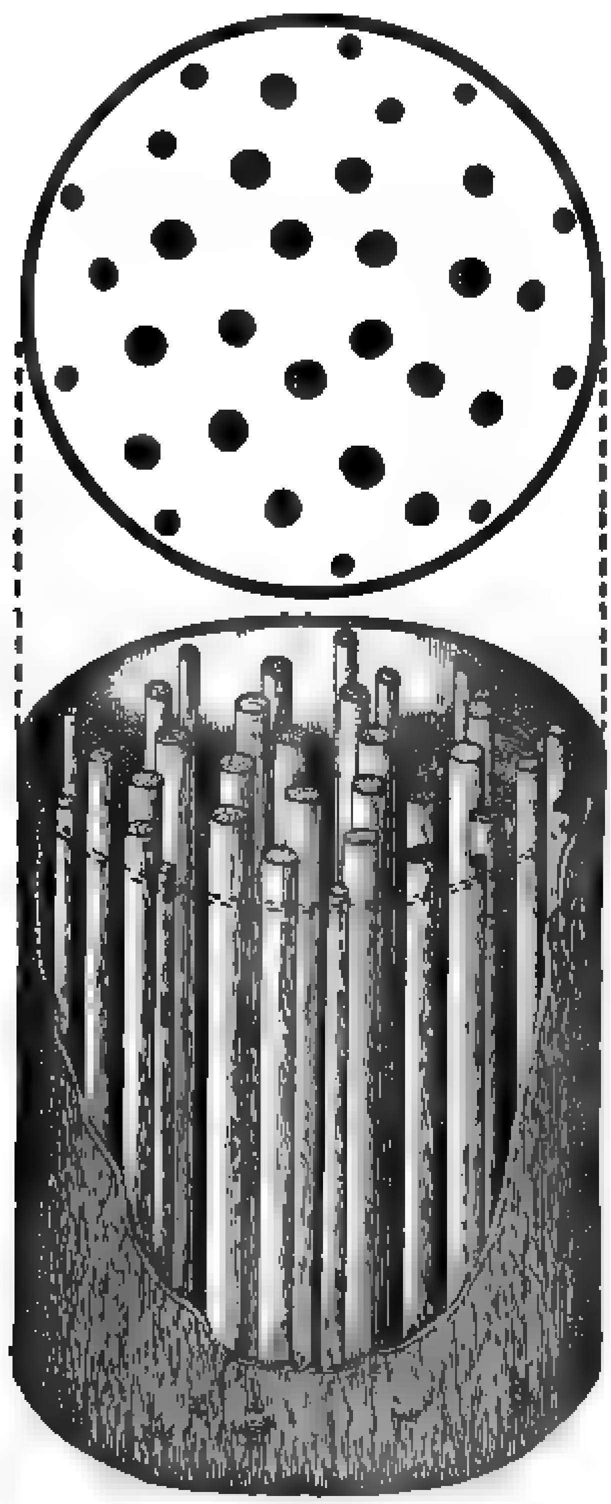


Fig. 81.

The fibro-vascular bundles do not always run so parallel to each other in monocotyls, but only in long internodes devoid of branches or rootlets. When rootlets are attached along the entire length of a rhizome, for instance, or when growth in length

is accomplished by the continual and successive formation of new leaves at the apex, as in palms, some of the fibro-vascular bundles from the interior of the plant are bent outwards to enter these rootlets or leaves, as is diagrammatically represented in the accompanying drawing of a longitudinal section of a palm stem (Fig. 82).

Drugs are recognized by the manner of the distribution and relation of the bundles to each other and to the other tissues rather than by the cellular elements of the bundles themselves, just as we recognize a friend by the relation of eyes, nose and mouth to each other and to the rest of the face, rather than by a conscious

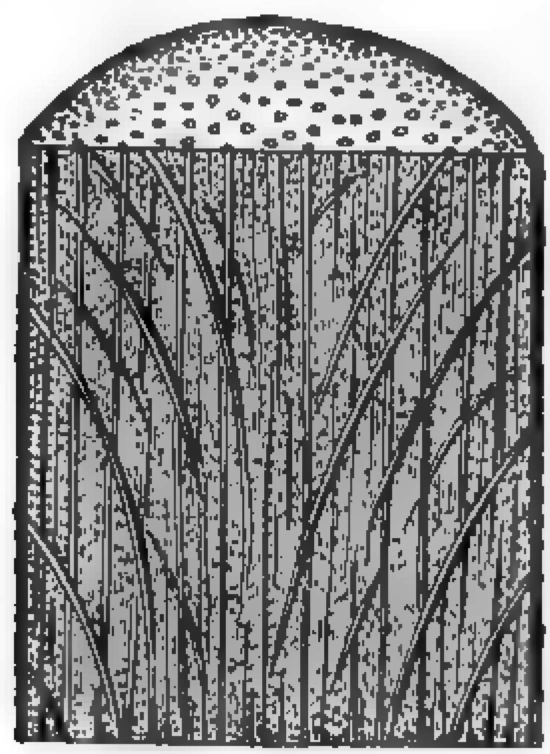


Fig. 82.

recognition of the exact color of eyes or hair, or by an observance of any minute peculiarities of the several features.

Besides the two methods of arrangement of stems with and without a nucleus sheath, as already figured, there are several other types of endogenous arrangement, which are of importance. One of these types may be seen in sarsaparilla, the peculiarity of which is that all the fibro-vascular bundles are closely aggregated just within the nucleus sheath, leaving a large pith-like parenchyma in the interior, as in Fig. 83; the other type may be seen in calamus, galanga, ginger, etc., where a nucleus sheath is present, but the bundles are scattered both within and without this

sheath, as in Fig. 84. In some cases, as in the sarsaparillas, the cells of the nucleus sheath are characteristic of certain varieties, so that they may be of diagnostic value.

Still other arrangements are found in the hollow stems of monocotyls, as in the culms of grasses, etc. Cut a section of

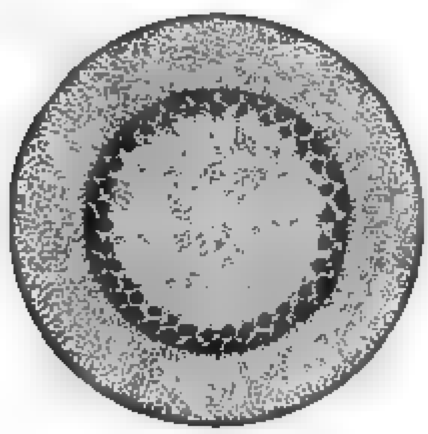


Fig. 83

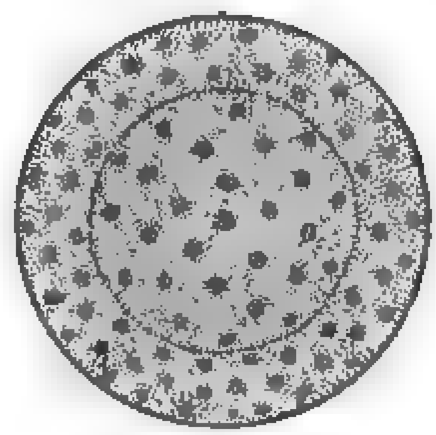


Fig. 84.

straw and the bundles are found arranged within the cuticle as in Fig. 85, while in the rhizome of couch-grass we find a nucleus sheath and the bundles within this, as in Fig. 86, while in both we see the large central cavity.

Fig. 85.

Fig. 86.

These figures, it should be remembered, illustrate diagrammatically the *types of arrangement* and not sections of individual drugs which may, and generally do, vary from the circular form, being quite frequently flattened or oval in section. We will postpone a consideration of the nature of the fibro-vascular bundles of

monocotyls until we have considered the structure of dicotyls and polycotyls (conifers), the *exogenous structure.*

To understand the structure of exogenous stems, let us examine the following three drawings, after Sachs. If we make a section at the extreme tip of the growing radicle or root of the castor oil plant *(Ricinus communis)* we would find only one kind of parenchyma cells, the fundamental tissue, but a section from near the end of this radicle soon after it makes its appearance beyond the seedcoats shows a circle of cells somewhat different from the cells of the fundamental tissue, as indicated by the shaded circle marked x in Fig. 87; this layer of cells is called *meristem* or *primary meristem*, and from it the fibro-vascular bundles are produced.

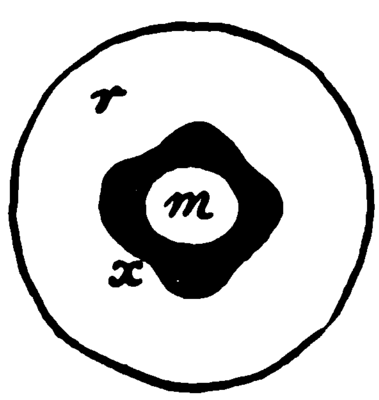


Fig. 87.

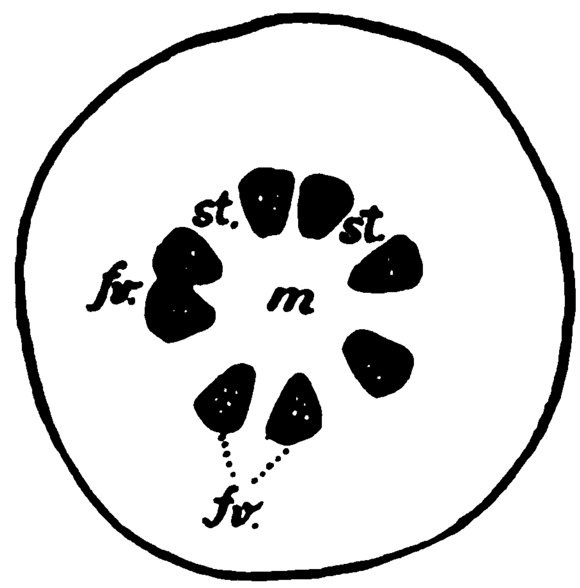


Fig. 88.

The fundamental tissue within this circle forms the *medulla* or *pith (m)*, while the fundamental tissue without this circle forms the *middle bark (r)*, the epidermis, or in older roots and stems the cork, forming the *outer bark.* It will be noticed that at some points the meristem layer is thicker than at others, and a section made from a root which is a little older, when the radicle has reached a length of about two cm. below the cotyledons, shows that each of the four thicker portions of meristem has developed into two clusters of cells *(fv)* which are cross-sections of fibro-vascular bundles, thus making a circle of eight fibro-vascular bundles *(fv)* shown in the shaded part of the drawing (Fig. 88), which are separated from each other by cells which resemble those of the pith *(m)* and the middle bark and which are the *medullary rays (st).* The pith or medulla, the middle bark and the medullary

rays together are all *fundamental tissue.* In Fig. 89 we see the development of the fibro-vascular bundles still farther advanced; *fv* shows the bundles, *m* is the pith from which the medullary rays radiate, *r* is the middle bark, but this drawing shows in addition some bands of meristem crossing the medullary rays, at *cb*, connecting the fibro-vascular bundles. Such connecting bands when present are called *secondary meristem,* and it will be noticed that they are continuous with similarly shaded parts pass-

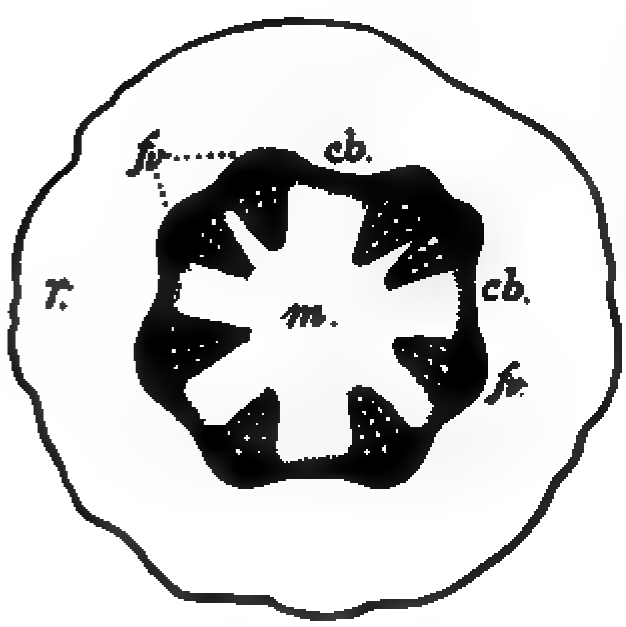


Fig. 89.

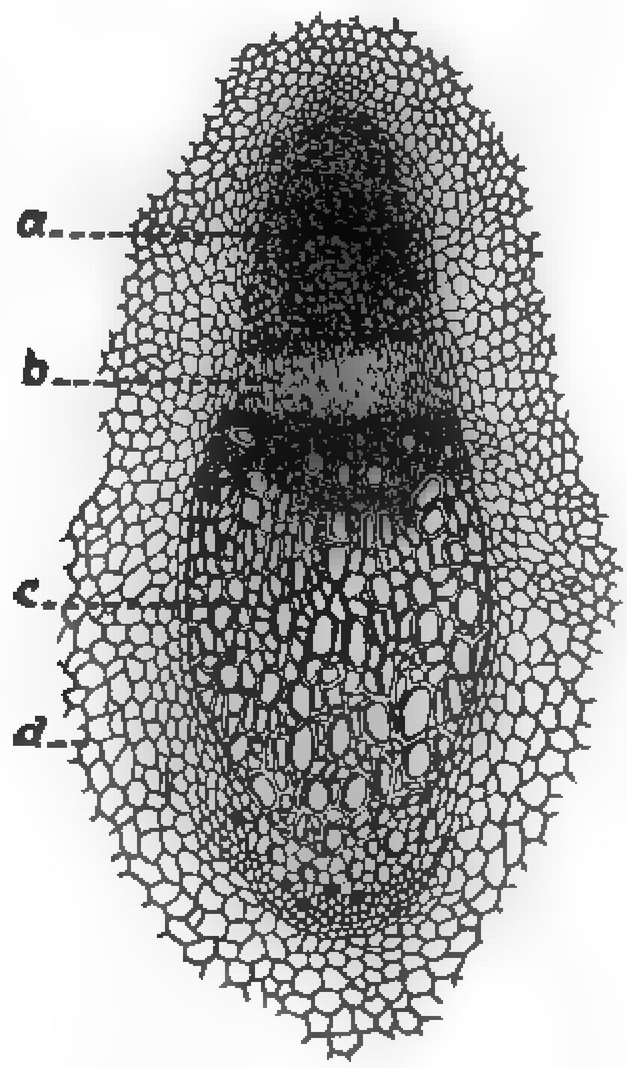


Fig. 90.

ing through the fibro-vascular bundles, and that these fibro-vascular bundles are arranged in a circle with the larger portion of each bundle within the meristem layer, and a smaller portion without the meristem layer, as is shown by the different shading of these parts in the last drawing.

To examine the nature of these fibro-vascular bundles we may make a transverse section of the rhizome of black cohosh *(Cimicifuga)* in which we find a large number of bundles of various sizes. Choosing one of the larger ones for examination (see Fig. 90) we

see that it is made up of three parts, an outer part called *bast* or *phloëm (a)*, an inner part called *wood* or *xylem (c)* and between them a part composed of very soft parenchyma cells constituting the *cambium (b)*; surrounding the whole bundle we see the parenchyma cells of the fundamental tissue *(d)*. As the bundle grows the cambium cells form new wood on the inner side and new bast on the outer side. The wood *(xylem)* consists mainly of prosenchymatous wood cells, with cell walls which have become hard by a deposit of *lignin*, together with (usually) ducts and (sometimes)

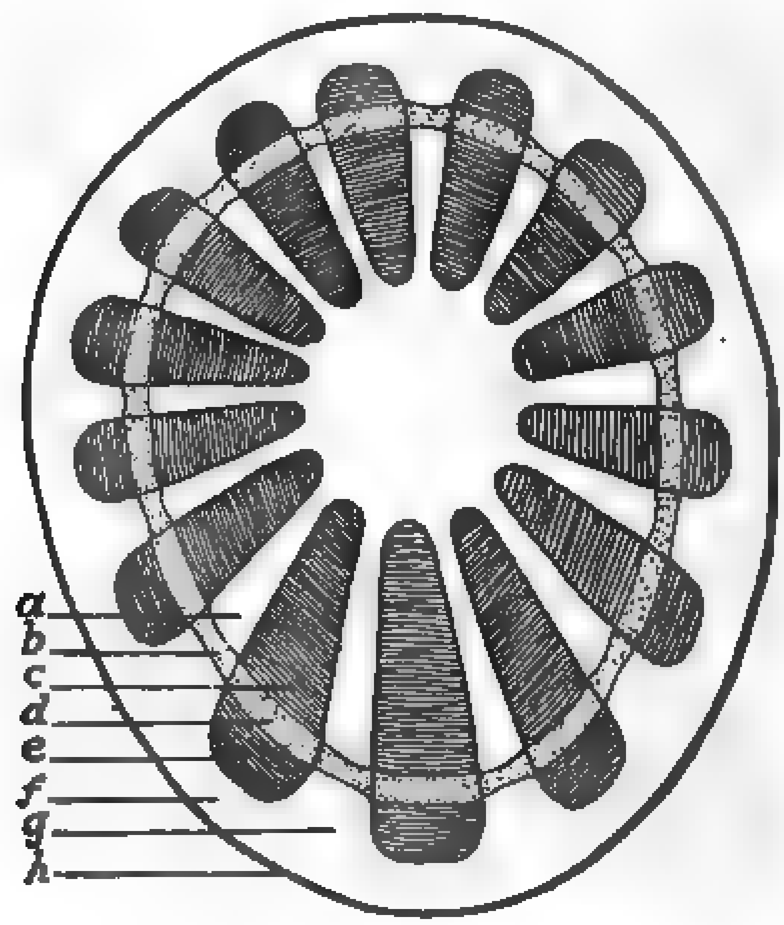


Fig. 91.

wood-parenchyma, the latter being cells of parenchymatous shape, but with thickened walls. The bast *(phloëm)* consists mainly of some soft walled parenchymatous cells, some sieve-ducts and, in many plants, thickened prosenchymatous *bast cells*, which latter aid in giving strength to the stem or root.

The relation of the fibro-vascular bundles to each other and to the other tissues is seen in Fig. 91, which is a drawing of the structure of yellow parilla *(Menispermum Canadense)*; as is always the case in di-cotyledonous or exogenous growth, the fibro-

vascular bundles are arranged in a circle; the central portion is the *pith* from which radiate the *medullary rays (a)* which separate the bundles from each other and connect the pith with the *middle bark (f)*; the xylem or inner portion of the bundles *(c)* is separated from the *phloëm* or outer portion *(e)* by the *cambium (d)*; the *cambium* of the various bundles is connected by bands of *secondary meristem (b)*, the two together forming the *cambium zone.* In woody plants all that lies within this cambium zone is called *wood* or *wood-cylinder* and all without this zone is called *bark.* The bark will be seen to be made up of three layers; the outer bark *(h)* consists of epidermis in young stems or roots and of cork in older structures; if the outer edges of all the bast portions of the fibro-vascular bundles are united by a line this line will mark the division between the *middle bark (f)* which consists of parenchyma or fundamental tissue, and the *inner bark,* which consists of alternate portions of bast *(e)* and the continuation of the medullary rays *(g).* It will be seen that bark cannot exist in an endogenous stem or root, because there is no cambium zone that separates the wood from the bast; in fact, the bundles are not divided into these three parts as here shown in di-cotyledonous structure.

Let us now suppose in regard to this exogenous structure, as we did in regard to the endogenous stem, that an X-ray might be found that would render all fundamental tissue in plants transparent or invisible while it left the fibro-vascular bundles and outer bark opaque and visible; removing a portion of the latter, and examining the interior we would see that the structure is as in Fig. 92, all the fibro-vascular bundles in a circle, with a pith space in the interior, medullary rays between and middle bark around them, the last three parts being transparent or invisible under the influence of our imaginary X-ray, but the space which they should occupy being plainly shown. Here also the projection of the section into the circle above shows the relation of such a section or map to the continuity of the tissues within the stem, and shows how such a transverse section, or a drawing of one, constitutes in reality merely a map, with which the idea of length or continuity must always be mentally associated.

The fibro-vascular bundles are represented as being separate throughout the length of the stem, but this is the case only in one type of *fleshy* di-cotyledonous stems, rhizomes, roots, etc., in which

the fundamental parenchyma tissue preponderates and the fibro-vascular bundles are few and arranged in a loose circle, as in Fig. 93. This is also the general structure of herbaceous di-cotyledonous plants, as in many of our annuals, vegetables, etc. Another

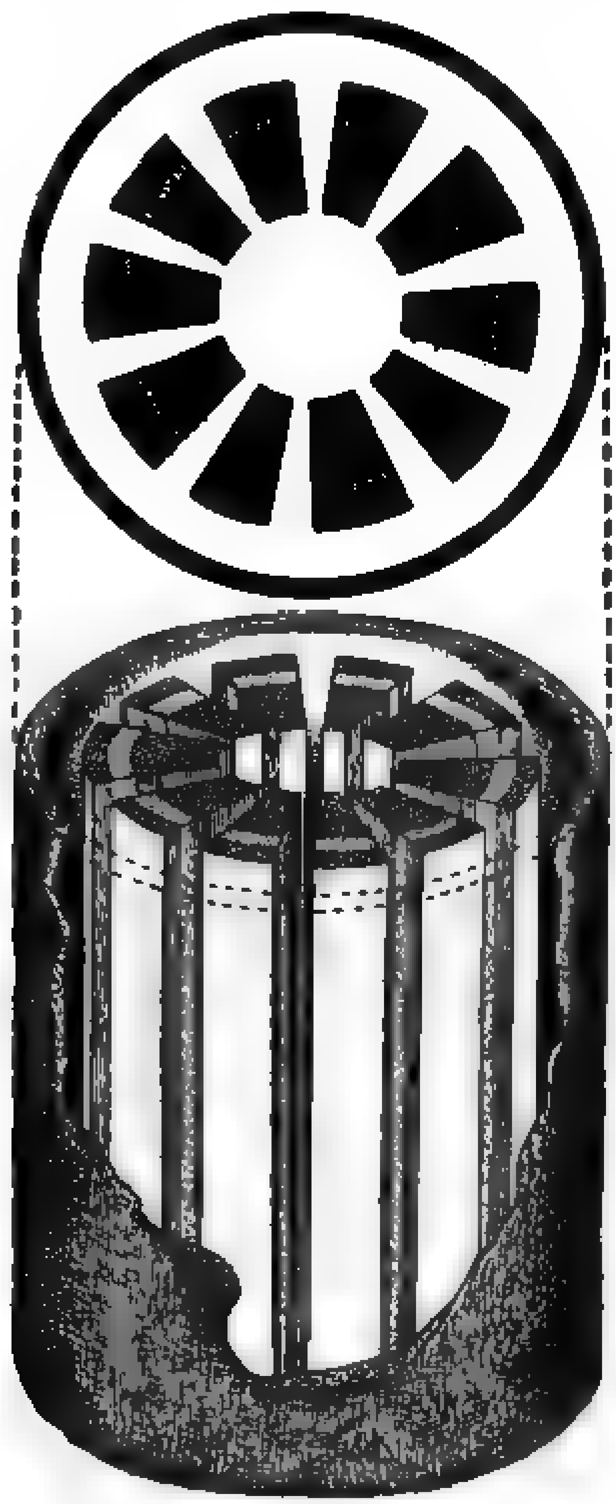


Fig. 92.

type of fleshy root or stem is when the bundles form a central wood-cylinder as in Fig. 94, but are not much lignified; the first plan is seen in masterwort and podophyllum, and the second is seen in dandelion. A modification of the latter plan is seen in senega, as

in these drawings (Fig. 95), where the wood-cylinder is not continuous, but is irregularly interrupted by wide medullary rays.

But the most characteristic exogenous structure is not seen in the fleshy plant axes, but in the *woody* roots and stems, in which there is but little fundamental parenchyma, the bundles are close

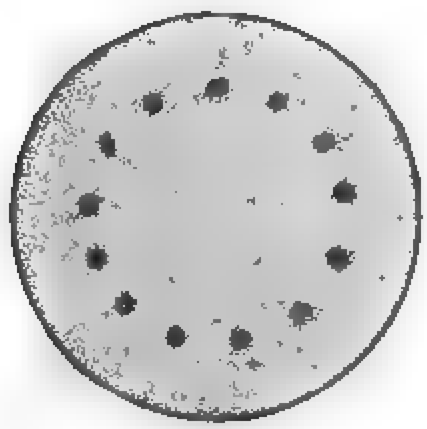


Fig. 93.

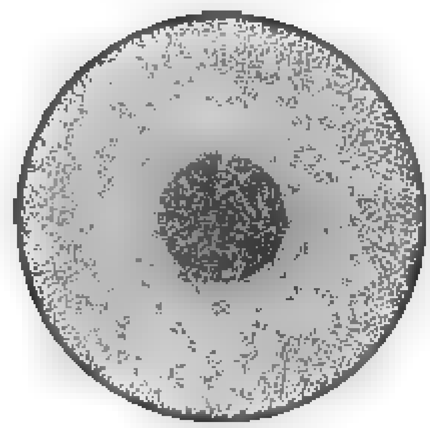


Fig. 94.

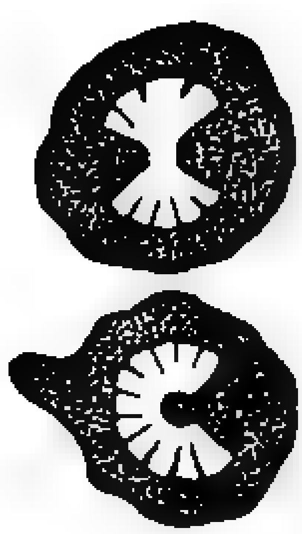


Fig. 95.

Fig. 96.

together, and interwoven, and the wood cells are strongly lignified and therefore tough. In such a stem the fibro-vascular bundles are separated only for short distances by the medullary rays and are united with each other sideways, with their prosenchymatous cells

interlacing. In some woods, as in white pine, this interlacing is not very intricate and this wood splits easily along the grain, but in other woods, as in *lignum vitae,* this interlacing is so intricate that even the hard usage given to tenpins and tenpin balls does not split the wood. The drawing (Fig. 96) represents diagrammatically a young twig of maple with the bark and cambium removed. It is readily seen that while a section a little farther up or down the stem will not show us the same bundles and the same medullary rays, yet one section must be practically identical with every other section, so that a drawing of a section will serve as a map of the structure equally as well as in the other examples illustrated, only with the additional proviso that we must bear in

Fig. 97.

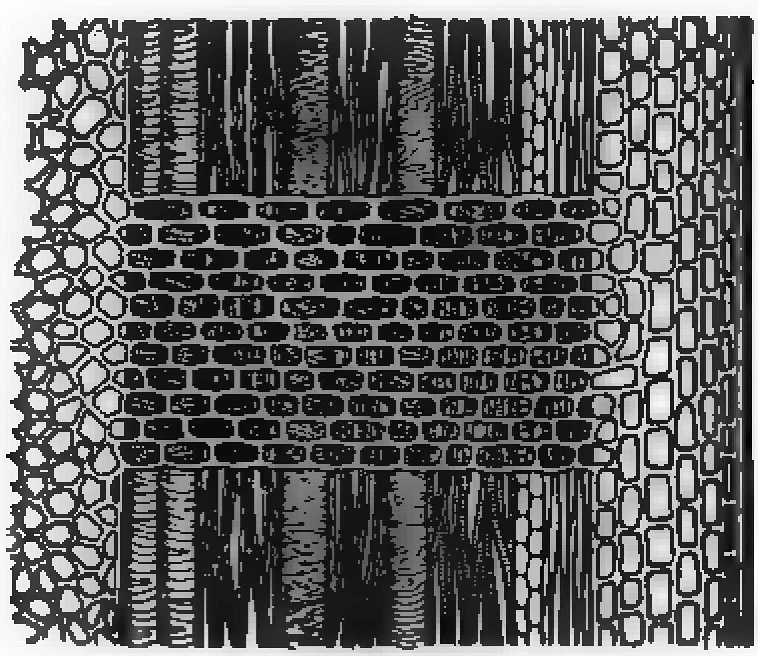


Fig. 98.

mind this joining of the bundles to form a solid and connected wood cylinder.

The *pith* consists of parenchyma and is often continuous throughout the length of the stem; in some cases, however, it is interrupted by wood, the fibro-vascular bundles anastomosing at the nodes, as for instance in the grape-vine, of which a longitudinal section is shown, and in which it is supposed that the fibro-vascular bundles from the side of the stem on which a leaf is placed by this means convey nourishment direct to the other side, on which a bunch of fruit is growing.

Sometimes the pith is present in young stems but ceases to grow as the stem enlarges so that the mature stem becomes hol-

low with only shreds of pith adhering to the inner surface of the wood-cylinder, as in bittersweet.

To the pharmacognosist it is of interest to know that stems contain more pith than the roots of the same plants, the roots often containing little or no pith when the stem contains a thick pith; this is often of diagnostic value in recognizing stems which have been added with fraudulent intent to drugs which should consist of roots only, as in belladonna root, bitter root, etc.

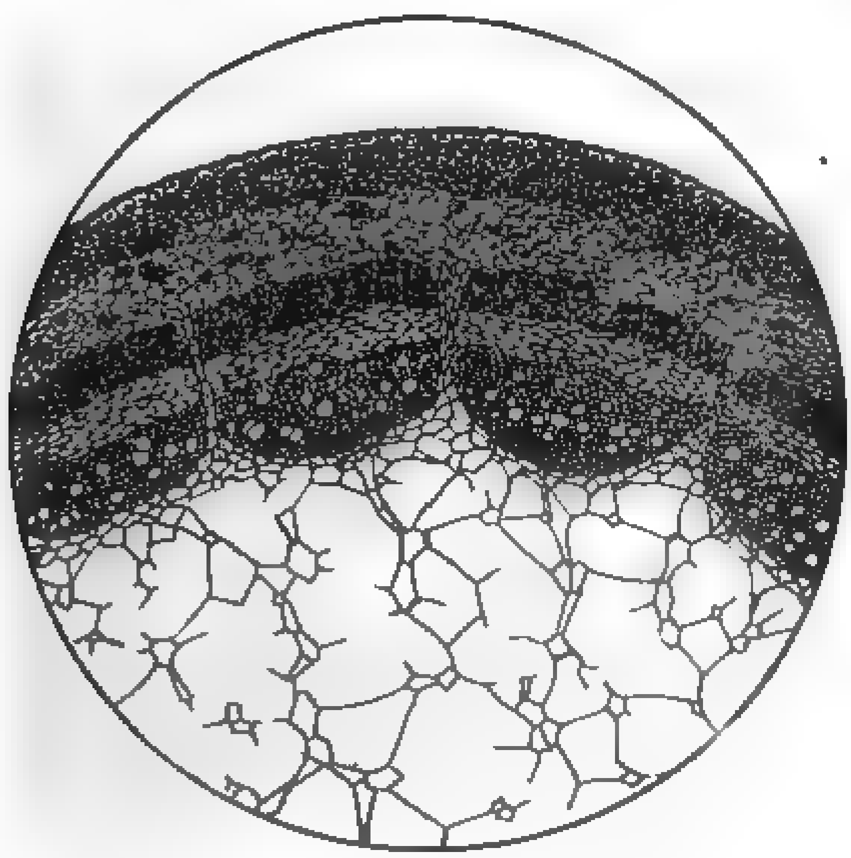


Fig. 99.

The *medullary rays* are seen as radiating lines in the transverse section, and in fleshy stems or roots they may extend for some distance up and down the stem, but in woody stems or roots, as we have just learned, they are of short length and often only one or a few cells in thickness. If we make a radial section in such a manner as to cut through a medullary ray we will see that it consists of cells stretched radially across the fibro-vascular bundles and uniting the pith *(p.) with the middle bark (m. b.)*, as is shown in Fig. 98. The function of the medullary rays is to conduct water and nourishing material to the inner parts of the stem, or at least as far inward as the sapwood extends. (See Woods, page 275.)

In Fig. 99 we see a transverse section of a young rose-twig with

the large-celled pith in the center, three medullary rays separating the four fibro-vascular bundles shown, and the whole surrounded by the middle bark and epidermis. The three parts of the fibro-vascular bundles, *xylem*, *cambium* and *phloëm* are plainly seen, and in the *phloëm* or bast of the second bundle from the right a notch is seen, indicating the beginning of a division into two bundles as will be more fully illustrated presently. If we examine a somewhat older twig from the same rose-bush (Fig. 100) we will find the following to have taken place during growth: The cells

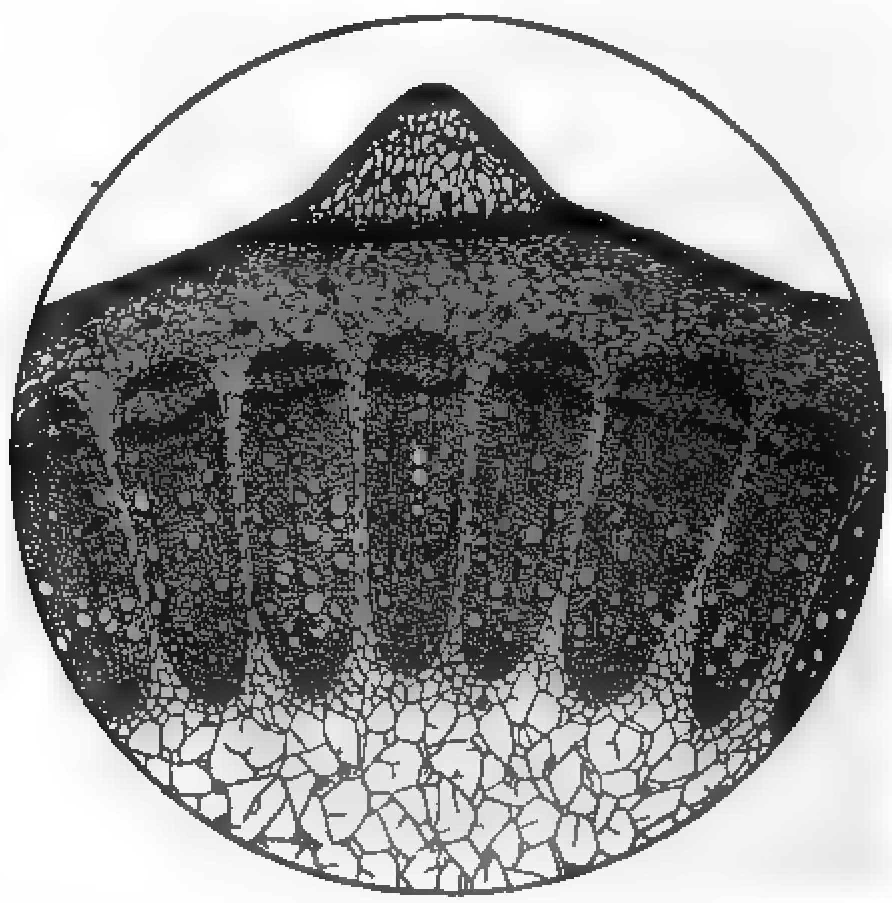


Fig. 100.

of cambium next to the xylem produced new wood cells, thus adding much to the radial dimensions of the fibro-vascular bundles, so that the latter became larger, and the wood became thicker and stronger. Meanwhile, also, more bast was produced from the cambium, but much more slowly than the wood.

This change of cambium into wood and bast continues as long as the leaves assimilate food, or, in other words, as long as the vegetative process keeps up, which varies with the plants, and depends on the seasons in their habitat, being uninterrupted in many tropical and subtropical regions where trees are found in

which this process has probably gone on without intermission from a time previous to the building of the Egyptian pyramids, while in subarctic regions the process may be limited to a few weeks' duration; in many plants the process extends only through a single season.

When the plant grows during a part of the year only, as in the perennial woody plants of the temperate zones, growth is suspended during winter, although roots may form below the frost-line even in winter, as in trees transplanted in the fall of the year, for which reason fall transplanting is usually more successful than

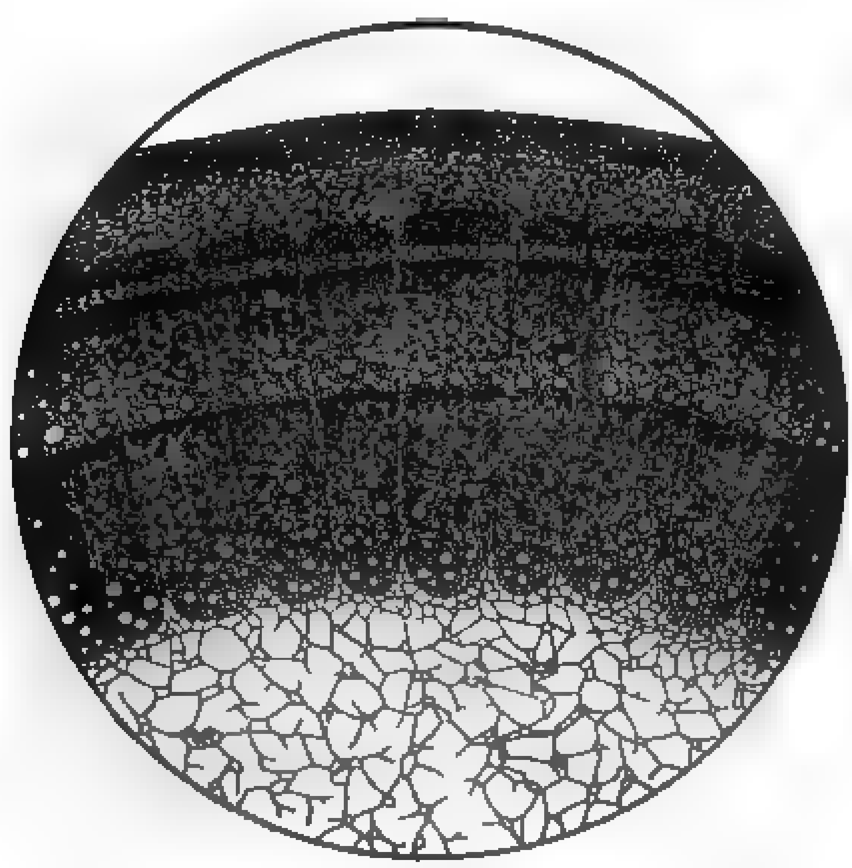


Fig 101

spring transplanting, the plant becoming in a degree established before overground vegetation starts up. In spring the earliest sign of returning activity of vegetation is manifested by a great turgescence of the cambium and of the adjacent cells, to such an extent, that, if wounded, enormous quantities of sap may flow out, as seen in tapping sugar maples for their sap, or in the "bleeding" of grape vines when these are trimmed too late in the spring. Then the buds expand, the leaves unfold, and the life of the plant actively goes on. The inner layer of cambium produces large ducts and large wood cells, and the new wood is

added in a ring around the wood of the previous season's growth; the process continues until, as the season goes on, the leaves harden, the stomata may be clogged with dust, the soil becomes parched by the heat of summer, and cell-formation gradually becomes slower and the cells smaller, while ducts may entirely cease to be formed, until, when the leaves have fallen, the year's work is completed and another ring of wood has been added around the former wood-cylinder, as is shown in the two rings of a section of a two years old rose-twig in Fig. 101.

These rings are generally easily distinguished, because in the

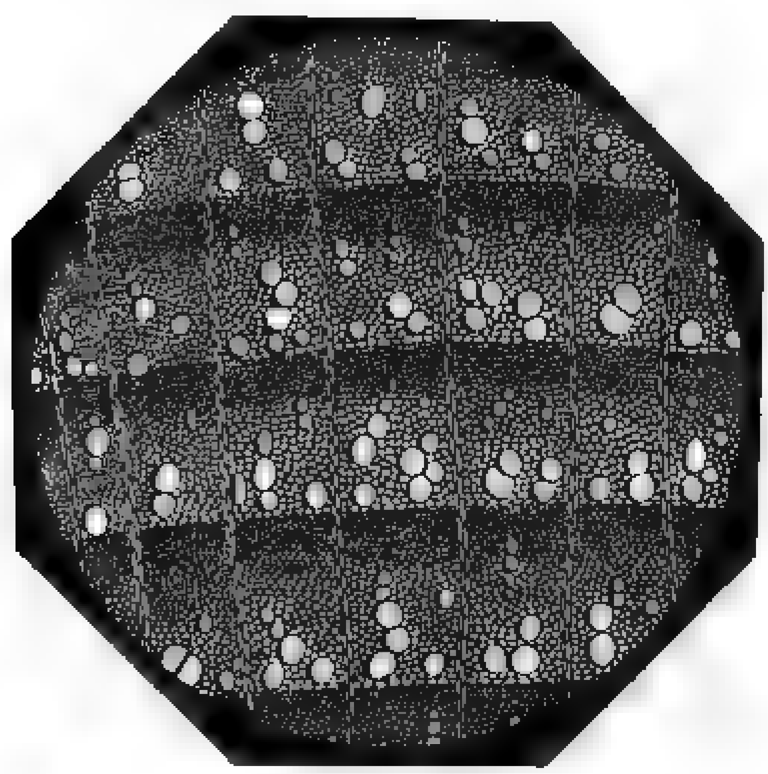


Fig. 102.

earlier part of the season, while growth is very active, a larger number of ducts and larger wood cells are formed, while towards fall the ducts are either smaller or entirely wanting and the wood cells also become smaller, so that the inner portion of each ring is more porous than the outer portion, as is shown in the section of the wood of sassafras root (Fig. 102); even in woods which have no ducts (wood of *gymnosperms* or *coniferae)* the difference in the sizes of the wood-cells makes the rings quite distinct.

In perennial stems a new ring of wood is thus added each year, and we call these rings *annual rings* or *layers* and as the newer rings are formed on the outside of the older rings, growth in thick-

ness takes place by the addition of new wood around the old, wherefore this is called *exogenous* (or *outward growing)* structure. By counting these rings from the pith outward, we can ascertain the age of the stem, as in Fig. 103, where we see segments of three annual rings between the two asterisks, the upper of which marks the cambium zone or margin between wood and bark, while the lower marks the boundary between the pith and wood. The three medullary rays crossing the ring of the first year are seen to continue outward to the middle bark; if no new medullary rays were formed it is evident that the fibro-vascular bundles would become very wide in a few years, but when they have attained a certain width, the bast divides, as seen in the

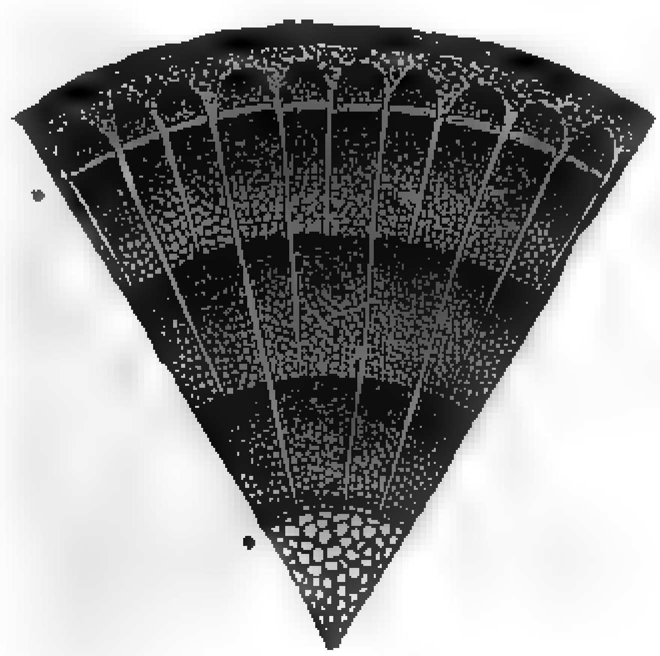


Fig. 103.

first section shown of the rose-twig (Fig. 99), and after that this notch continues outward as a new medullary ray, so that the fibro-vascular bundles are divided year after year and approximately the same tangential dimensions of the bundles are maintained. In the last drawing (Fig. 103), for instance, eleven rays cross the segment of the third year's ring corresponding to the segment of the first year's growth with only three rays; and the division is seen to have occurred in early spring at the commencement of each year's growth, and after new rays are started they continue outward through the successive layers, so that while we can trace an original ray from the pith to the middle

bark, we cannot trace back all the rays from the bark to the pith.

In some cases the fibro-vascular bundles divide during the year's growth, as seen in the section of a rootlet of black cohosh, shown in Fig. 104.

Of course it will be understood that annual rings are not found in fleshy or annual dicotyls, nor in the annual stems of perennial plants, but only in perennial woody stems and roots.

In tropical climates vegetation continues more or less actively

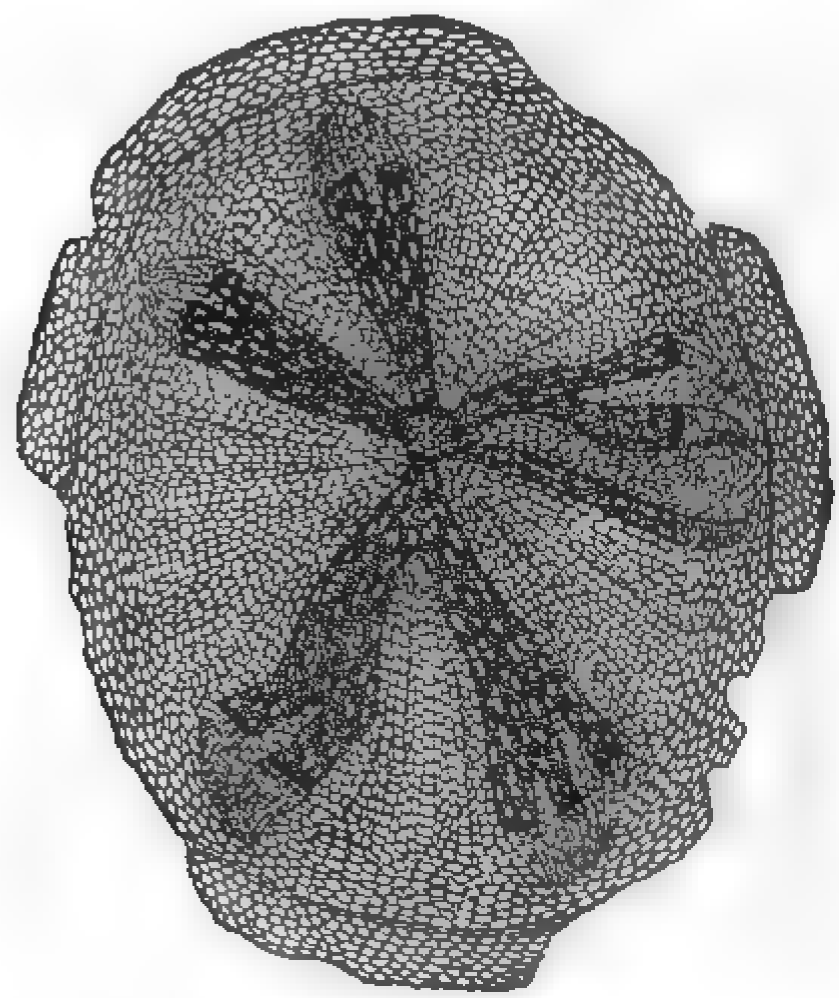


Fig. 104.

throughout the year and in many plants the rings are not concentrically continuous; they are then called *spurious rings,* as in false pareira brava, illustrated in Fig. 105, in which some layers only go part of the way around, while, in this particular section, one layer is in the form of a spiral which commences at *sp.* and makes three turns.

In vascular acrogens we also find fibro-vascular bundles, usually arranged in circles, and often of peculiar shapes on transverse sections as seen in this drawing of a segment of a stem of

tree fern (Fig. 106); the fibro-vascular bundles of ferns consist almost altogether of scalariform ducts.

When the stipes or bases of fronds are broken from the stem or rhizome of a fern, they often leave peculiar reticulated markings on the outside of the stem. The *acrogenous* structure is of little importance to the pharmacognosist, as only two drugs of this kind are used, of which only one, malefern, is important.

We are now prepared to understand one more feature concerning fibro-vascular bundles, namely, the difference between *open* and *closed* bundles. In exogenous structures, as we have just learned, a bundle may continue to grow by additional development of wood from the cambium for an indefinite number of years, and such a bundle is said to be an "open" bundle; in endogenous struc-

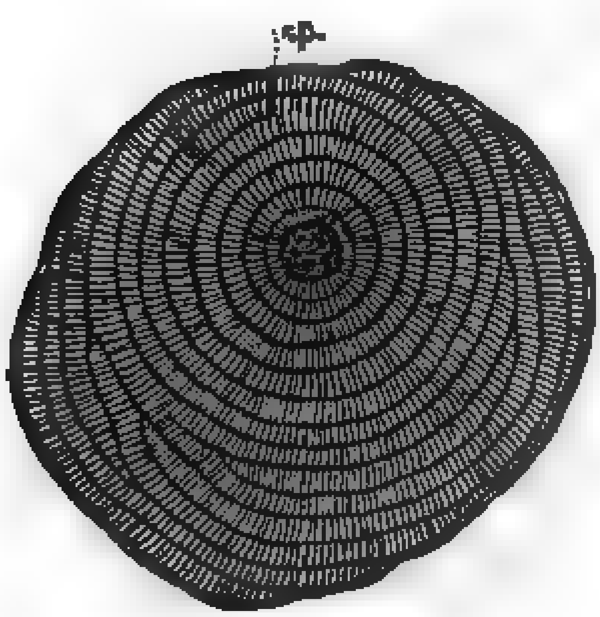


Fig. 105.

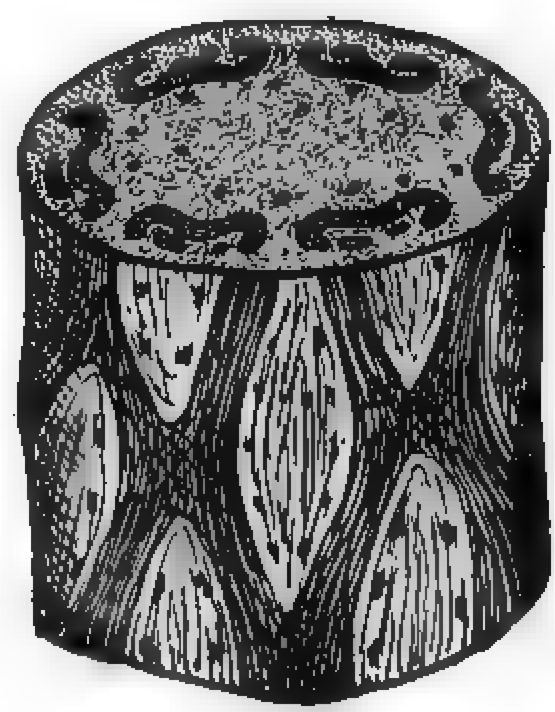


Fig. 106.

ture, however, the cambium is finally all changed to wood, ducts or wood parenchyma and the growth of the bundle ceases, and such bundles are said to be "closed" bundles.

To distinguish the cambium of the closed bundle from that of the open bundle, the former is sometimes called "procambium." The accompanying drawing shows a section of the fibro-vascular bundle of ginger (Fig. 107).

The transition from the young and still growing fibro-vascular bundles of a mono-cotyledonous stem to the fully formed and closed

bundles, may be studied in a transverse section of bamboo cane, of which a photomicrograph follows (Fig. 108), in which the interior bundles are seen to have many soft-walled cells, while those of the exterior portions are all or nearly all lignified; as the cut

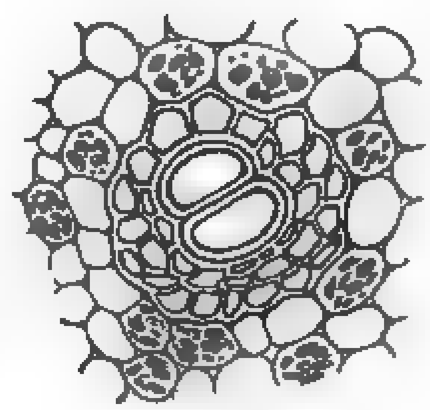


Fig. 107.

is shown, the cuticle is on the right and to the left we see some of the interior bundles. The bundles of the interior are not yet closed, but in the outer bundles cell-formation and cell-activity have ceased, and the latter are therefore "closed," and between

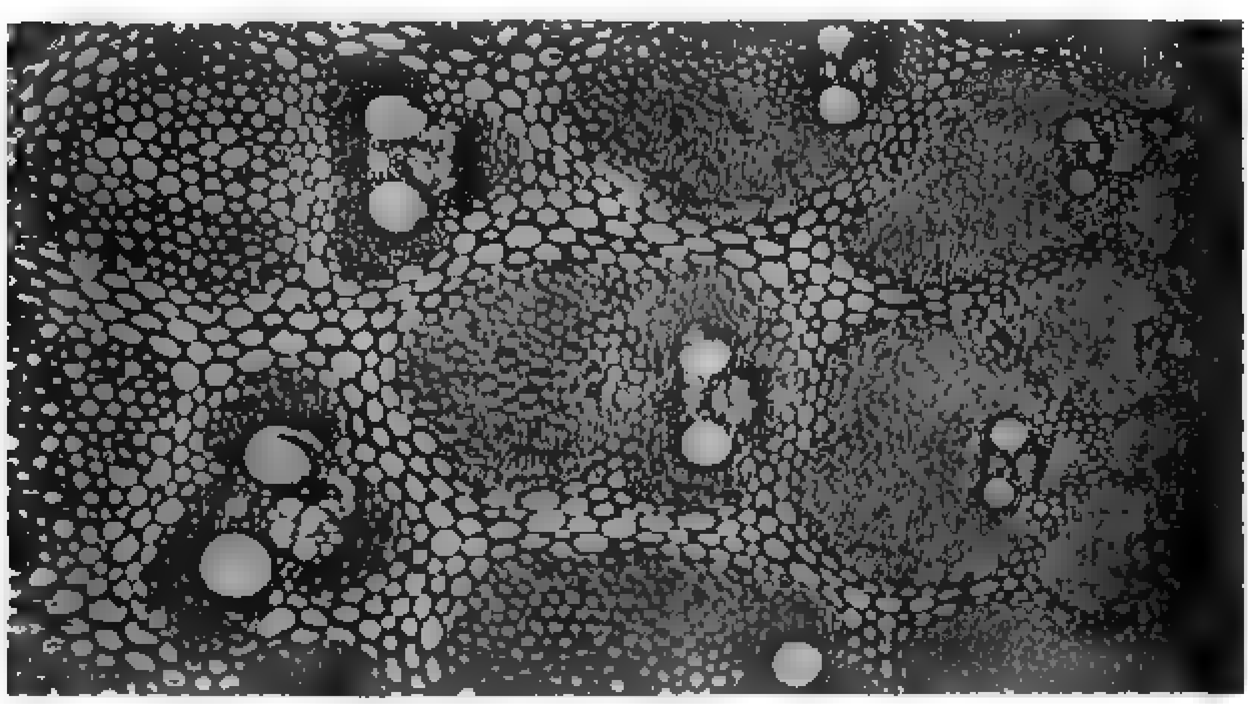


Fig. 108.

these two extremes there are all degrees of gradation between the youngest bundles still nearly all procambium, and the oldest in which procambium has been entirely replaced by formed material.

The student will find excellent material for the study of

closed fibro-vascular bundles in many of the drugs of mono-cotyledonous origin, and especially in the stem of Mexican sarsaparilla, and it is recommended that sections of as many as possible of these drugs be made.

It is unnecessary to dwell on any further details in regard to the closed bundles of monocotyls, for ordinarily they may be considered as mere dots in the section, but, of course, if the bundles present some peculiarity that is uniformly alike and characteristic, such bundles may be of diagnostic value. In a variety of rush *(Juncus effusus)*, for instance, one bundle is similar to every other bundle, each having the same number of ducts and large intercellular spaces, regularly arranged as shown in Fig. 109, so that a fragment of a section containing even a single

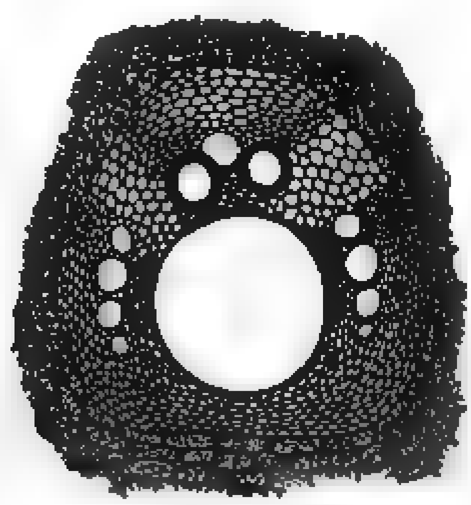


Fig. 109.

bundle might enable one to recognize the identity or origin of the specimen.

Closed fibro-vascular bundles are also found in acrogens and in some annual dicotyls, as well as in the skeletons of the leaves of both dicotyls and monocotyls.

ROOTS

In pharmacognosy we restrict the word "root" to its botanical meaning as referring to the descending axis of plants, but the theoretical characteristic of a "root-cap" is not recognizable in drugs of this class. The trade use of the word "root" to designate all forms of underground parts, as rhizomes, tubers, corms, bulbs, etc., is wrong and confusing and should be avoided.

Roots are distinguished from stems by having no nodes or internodes, no buds, little or no pith, no cryptogamous growths on the bark, and by their irregular branching. Drugs consisting of main-roots, with or without branches, taper from the stem-end to the tips of the roots or branches, as the case may be.

When a root has a thick head to which the remains of several or many stems are attached, such head is called a "caudex," as in dandelion and senega; when such a caudex is present it is often a diagnostic feature of the drug.

Secondary roots from rhizomes are of nearly uniform diameter and seldom branch, and have but very few and small fibrous rootlets; when rhizomes come into trade with their roots attached the latter are called "rootlets."

The microscopical structure of roots is similar to that of stems, and has already been described.

We group roots as follows:

ROOTS	Mono-cotyledonous				16
	Di-cotyledonous	Woody	thin bark		17
			thick bark	with ducts	18
				without ducts	19
		Fleshy	with ducts		20
			without ducts		21

The ducts here referred to are oil, resin, or latex-ducts or spaces, or, in some cases, even large special cells.

GROUP XVI

Mono-cotyledonous Roots

Only two mono-cotyledonous or endogenous roots are used as drugs; Sarsaparilla and Vetivert. Both of these drugs are rootlets from rhizomes, and are therefore of uniform diameter throughout.

Very long, about 4 to 5 mm. thick; brownish................**Sarsaparilla**
Thin and slender, about 15 to 20 cm. long, and about 1 mm. thick..**Vetiveria**

Sarsaparilla

N. Sarsaparilla.—**O.** Root of *Smilax officinalis, S. medica, S. papyracea,* and of other undetermined species of *Smilax; Liliaceæ.* —**H.** Mexico, Central America and Brazil; also cultivated in

Jamaica.—**D.** Slender roots, often over two meters long, about 4 to 5 millimeters thick, cylindrical, longitudinally furrowed or wrinkled, and breaking with an abrupt, sometimes mealy, sometimes horny fracture; externally grayish-brown or reddish-brown; internally white and mealy or horny; nearly or quite inodorous, and with a slightly mucilaginous, at first bitter and afterwards also acrid taste.—**C.** The active constituent is variously known as parillin, smilacin, salseparin, parillinic acid, etc.—**U.** Generally reputed to be alterative, and popularly much esteemed as a "blood-purifier" but probably of little or no real medicinal value. Dose: 2 to 5 grams, best given in the form of fluid extract or syrup.

Sarsaparillas are generally classified as: 1, *mealy sarsaparillas*, in which the parenchyma cells most frequently contain unaltered starch grains; and 2, *non-mealy sarsaparillas*, in which altered starch in the form of a pasty mass preponderates in the parenchyma cells. This classification does not seem to have much scientific merit, pharmacognostically or otherwise, except in so far that a mealy or starchy sarsaparilla—be it Honduras, Para, Mexican or Jamaica—is probably a sounder drug than a non-mealy one. It is not improbable that all sarsaparillas would be mealy if gathered at the right season, or if collected and cured with proper care; or it may be that the roots are non-mealy only in those parts which are exposed or covered by only a thin layer of earth in the growing plant, as the portions nearest the "chump" (rhizome) are almost always non-mealy and shriveled, while the ends of the roots, even in non-mealy kinds, are usually plump and mealy. Non-mealy sarsaparillas, which include Mexican and Jamaica varieties, are thin shriveled, deeply wrinkled, with less unaltered starch grains, and often horny on fracture.

PARA SARSAPARILLA (also called Brazilian, Rio, Rio Negro, or Lisbon): The roots without the chumps, cut to even lengths and wrapped in handsome bundles, as shown in Figs. 110 and 113; these bundles are about one to one and one-half meters in length, and twenty-five to thirty-five centimeters thick, but this variety is not often used, although it is considered to be the best. *Guatemala* sarsaparilla is a variety of Brazilian sarsaparilla which comes into trade in smaller and looser bundles than the last mentioned; and

Guayaquil sarsaparilla is still another variety of the Brazilian drug which comes in bales, without being put up in bundles.

HONDURAS SARSAPARILLA (Fig. 111) is considered by many to

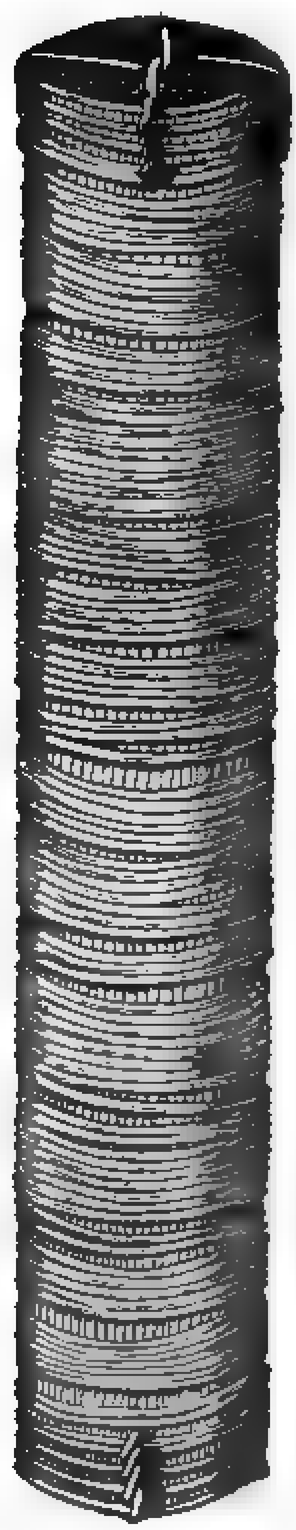


Fig. 110.

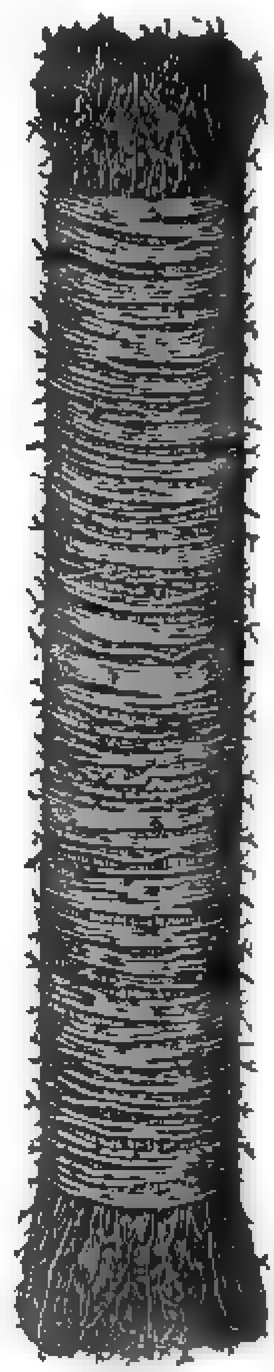


Fig. 111.

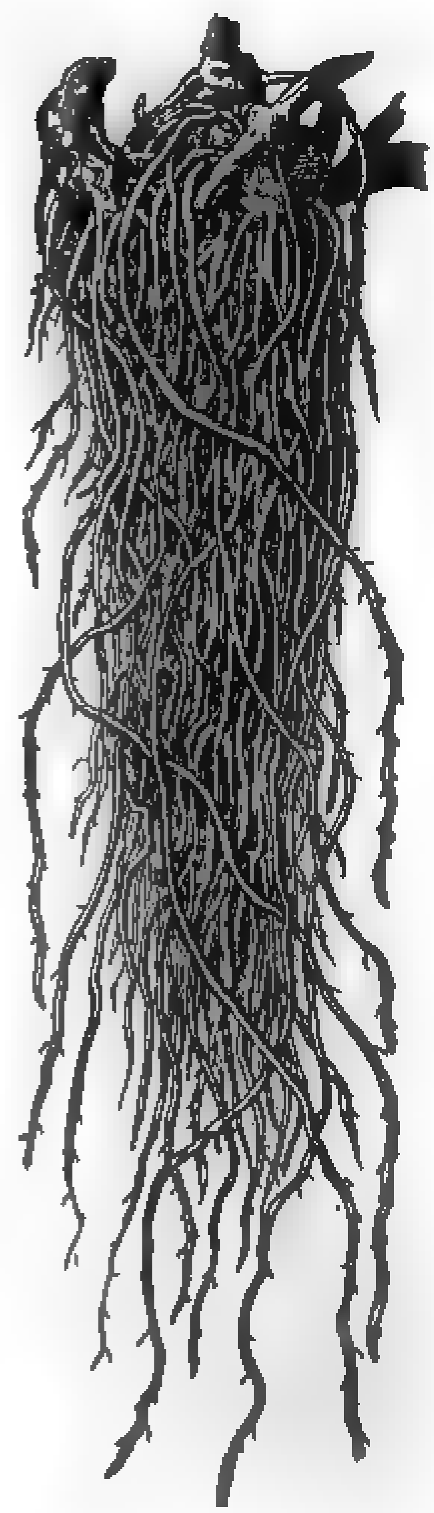


Fig. 112.

be fully equal if not superior to Rio sarsaparilla, and it is highly esteemed in this country. It comes into trade in bundles about sixty-five centimeters to nearly one meter long, and from ten to fifteen centimeters thick, and of the form as shown in the draw-

ing, although they are often more loosely wrapped. Sometimes the bundles consist of roots only; sometimes the chumps remain attached; and sometimes the interior of the bundle is filled with pieces of the chumps chopped up and carefully hidden by the roots which are wrapped around them, which of course constitutes an adulteration. This variety is plump, little wrinkled, and of a brown color, and it has more small rootlets attached to the roots than in Rio sarsaparilla.

Mexican Sarsaparilla (Fig. 112) comes into trade in bales containing about one hundred kilos. The roots are always attached to the caudex or chump, as represented in the drawing, and often quite long ends of stems remain and a mass of earth or clay adheres to the chump, thus materially adding to the weight. This kind of sarsaparilla is deeply wrinkled, and of a grayish-brown color. Mexican sarsaparilla is sometimes also called *Vera Cruz* sarsaparilla; and *Caracas* sarsaparilla is also but a variety of the Mexican.

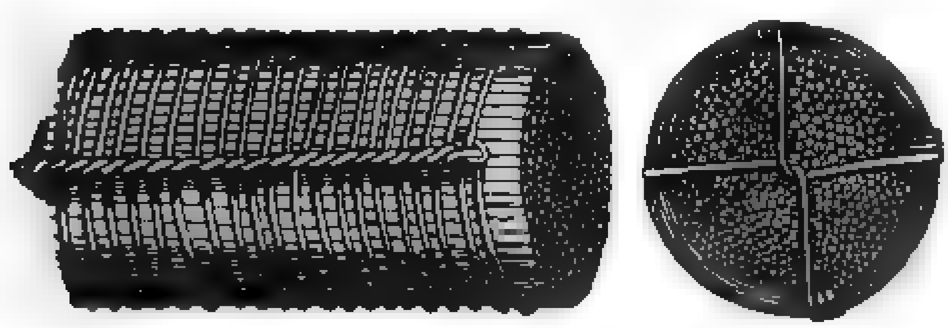


Fig. 113.

Jamaica Sarsaparilla is so little used in this country that it needs but little mention. It comes in small, loosely wrapped bundles, and is reddish-brown with numerous small rootlets which beset the roots and which give to this variety the descriptive name of "bearded" sarsaparilla.

The Pharmacopoeia (viii), speaking of all kinds of sarsaparilla, directs that "the thick, woody, knotty rhizome, if present, should be removed;" it is probable that the rhizome is at least equally as valuable as the roots, and in China root (the rhizome of *Smilax China*) the rhizome alone is used and the roots are rejected; the stems and adhering earth should be considered as adulterations, but the rhizome part is equally as valuable as the roots and should not be directed to be thrown away, especially as the concurrence

of most authorities is to the effect that all parts are medicinally nearly or quite worthless.

The microscopical structure is similar in all varieties of sarsaparilla. When a section of a dry root is cut the circumference is seen to be deeply indented, but when the roots are soaked for making sections to be examined by transmitted light, the roots become round and plump; the sections illustrated in some works are wrong because they represent dry sections in outline but with the details which can be only seen in thin sections which have been cleared and which are examined by transmitted light, and

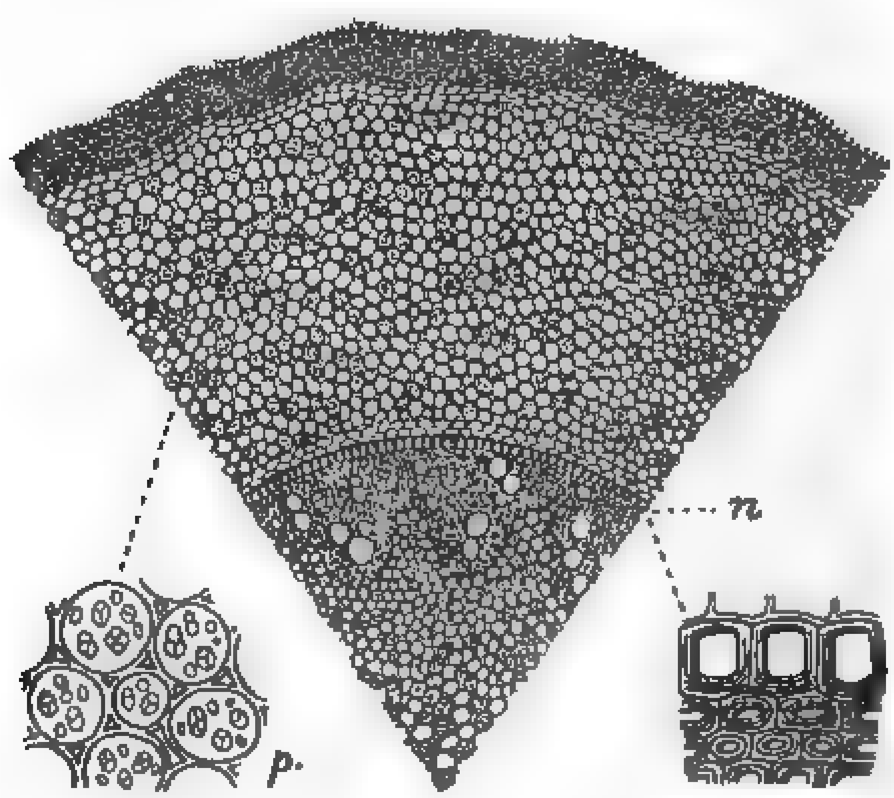


Fig. 114.

which are round. A segment of a section of Caracas sarsaparilla is represented in Fig. 114, from which the whole section may be readily imagined. The outer portion consists of a cuticle, and at places which were at the bottom of the wrinkles in the dry drug epidermal hairs are often attached to this cuticle; immediately below the cuticle is a more or less thick layer of sclerenchymatous cells, and inside of this a layer of parenchyma of considerable thickness containing more or less starch according to the variety under examination; and to the left of the segment of the section a portion of this parenchyma is shown more highly magnified.

Then comes a layer of cells forming the nucleus sheath, a few of which are seen enlarged to the right of our drawing; within this nucleus sheath the fibro-vascular bundles are crowded into a continuous circle of wood, and the central portion within this woody layer consists of a pith similar in structure to the parenchyma out-

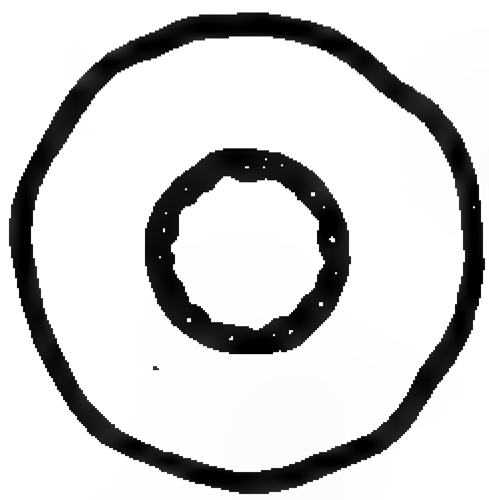


Fig. 115.

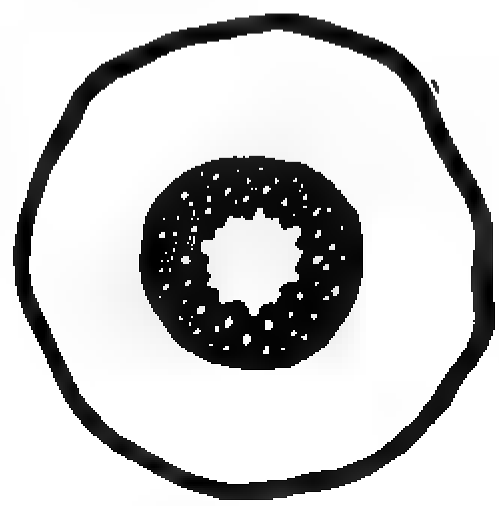


Fig. 116.

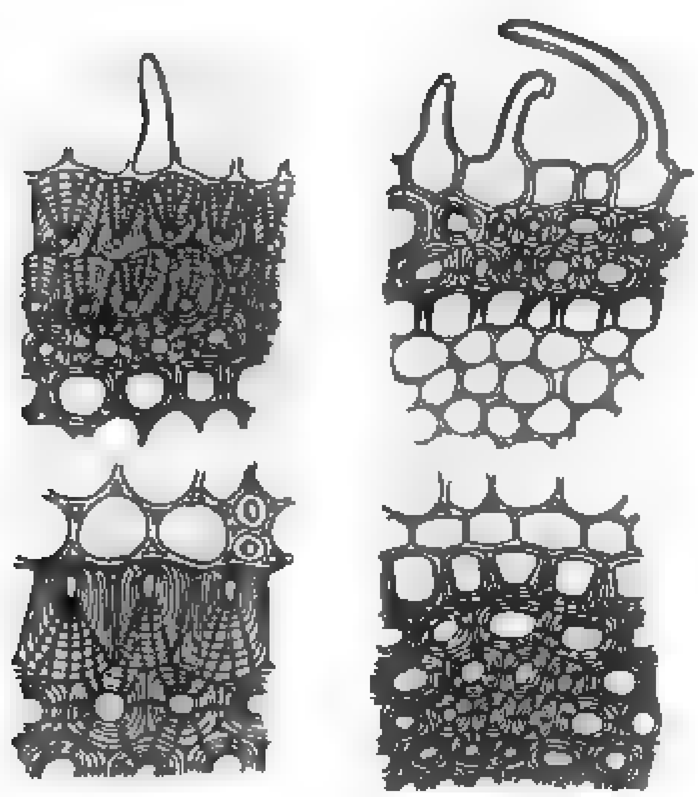


Fig. 117.

side of the nucleus sheath. The portion outside of the nucleus sheath is sometimes called the "cortical layer," but this term is misleading as it suggests a "bark," which, as we have already learned, does not exist in endogenous stem or root structures.

According to Schleiden sarsaparillas growing south of ten degrees north latitude have an inner parenchyma or pith which is

from three to eight times as thick as the woody layer, as is seen in Fig. 115, which represents Rio sarsaparilla; and sarsaparillas growing north of the same line have a pith which is at most only one and one-half to two times the thickness of the woody layer, as is shown in Fig. 116, which shows Honduras sarsaparilla.

The peculiar thickening of the subcuticular portion and of the nucleus sheath affords additional means of identifying the different varieties of sarsaparilla, but we cannot enter into detail of this kind, but must be content with showing these parts from two varieties only. The upper drawings (Fig. 117) represent the subcuticular cells from Vera Cruz sarsaparilla on the left, and of Honduras sarsaparilla on the right, while immediately below each is a drawing of a few cells of the nucleus sheath of the same varieties. The best test of the value of sarsaparilla is in the freshness and plumpness of the drug, and in the acridity of the taste.

Vetiveria.

N. Vetivert, Radix Ivarancusae.—**O.** The rootlets of *Andropogon muricatus; Graminaceæ.*—**H.** East India.—**D.** Slender, tough, string-like rootlets, about fifteen to twenty centimeters

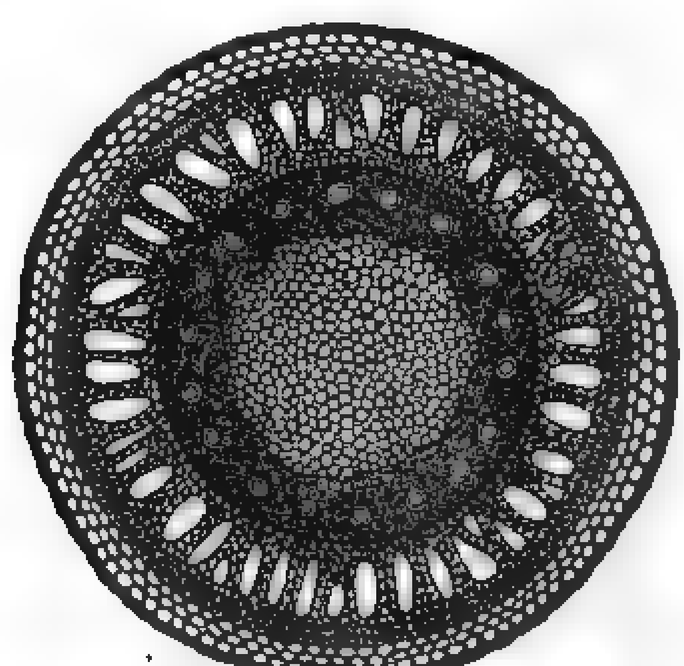


Fig. 118.

long and one millimeter thick, some with and some without smaller fibrous branchlets; yellowish-brown; somewhat waxy on fracture; the section (Fig. 118) showing large air passages in

the outer portion, with some resin cells, and a bright-yellow wood portion which contains about eighteen large ducts in a circle; aromatic and balsamic.—**C.** Resin and volatile oil.—**U.** Used altogether in the manufacture of perfumery, especially as an ingredient of sachet powders; sometimes sold in bundles tied with strings or ribbons, the whole bundles to be used as sachets.

GROUP XVII

Woody Exogenous Roots with Thin Bark

In woody di-cotyledonous or exogenous roots the wood forms a complete, rigid, firm and hard wood-cylinder, which can be separated more or less readily from the bark; with thin bark are those in which the bark is considerably less thick than the wood, often only one-sixth or one-eighth as thick as the latter.

Brown or purplish-brown; wood tough........................**Krameria.**
Blackish-brown and warty; wood in irregular circles or rings..**Pareira.**
Wood firm and yellow; taste very sweet....................**Glycyrrhiza.**
Yellowish-brown; tough, yellowish wood....................**Gelsemium.**
Large grayish-brown; often with rootlets braided............**Methysticum.**
Thin pale-brown bark, often scaling off and showing white wood ....**Hydrangea.**

Krameria

N. Krameria, Rhatany.—**O.** The root of *Krameria triandra* and *K. Ixina; Polygalaceæ.*—**H.** South America.—**D.** Two kinds of rhatany are common in the trade, and either may be used when this drug is prescribed: *Peruvian* or *Payta* rhatany *(K. triandra)* from Peru and Bolivia, and *Savanilla* rhatany *(K. Ixina* and *K. argentea)* from New Granada and Brazil. The drawing (Fig. 119) shows Peruvian rhatany somewhat reduced in size; it is from one to three centimeters thick, with a knotty several-headed caudex, and is branched below; bark irregularly fissured, more or less rough, externally blackish-brown or dark reddish-brown, coarsely fibrous. The wood is lighter red-brown, tough, and in the thicker pieces shows heartwood of a darker color; this is shown in the left-hand drawing of a section of the thick root, the accompanying smaller section being that of a root branch. The bark is

very astringent, but the wood is almost tasteless; owing to the greater proportion of bark in the smaller roots, as indicated in the section, the drug is valuable in direct ratio as the thicker pieces are rarer. Savanilla rhatany is less knotty or branched, shorter and more chocolate or purplish-brown, with scattered transverse fissures: the bark is more brittle than that of Peruvian rhatany, and proportionately thicker, as shown in the right-hand drawing of a section, so that this variety really be-

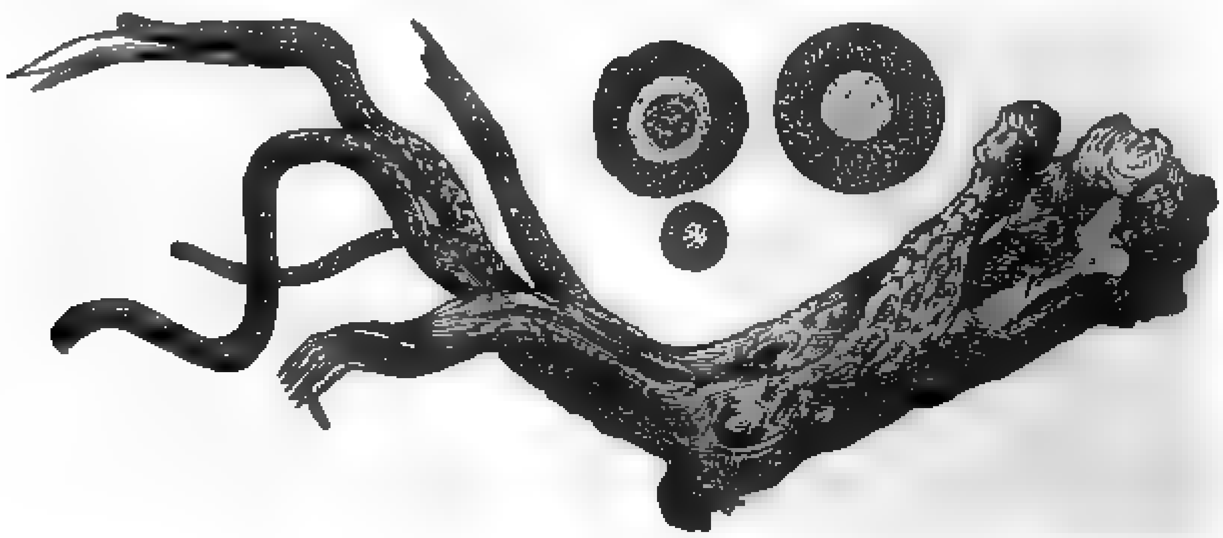


Fig. 119.

longs in Group XIX, but is spoken of here for convenience.—**C.** About twenty per cent of kramerio-tannic acid, red coloring matter, etc.—**U.** Astringent, useful in chronic diarrhoeas, etc. Dose: 0.5 to 2 grams, preferably in form of fluid extract.

Pareira

N. Pareira, Pareira Brava.—**O.** The roots of *Chondodendron tomentosum; Menispermaceæ.*—**H.** Brazil and Peru.—**D.** Pieces from a decimeter to a meter or more long, but generally cut into lengths of about ten to fifteen centimeters; varying in thickness from one or two to fifteen centimeters; cylindrical or irregular on transverse section; often tortuous; externally blackish-brown, with transverse ridges or warts and longitudinal furrows; internally pale-brown with a waxy luster when freshly cut; inodorous; taste bitter. The illustrations show the whole drug and its section in natural size (Fig. 120; upper right-hand drawing); the bark is thin and there is no pith; the wood is arranged

in several circles which sometimes are very irregular; at the ends of the pieces the tough and separated bundles often project, as shown in the drawing.—**C.** Pelosine, identical with bebeerine.—**U.** Alterative diuretic, useful in cystitis and pyelitis, etc. Dose: 2 to 5 grams, best given in form of fluid extract.

The books mention several other roots which are used as admixtures or substitutions, but the genuine is so characteristic

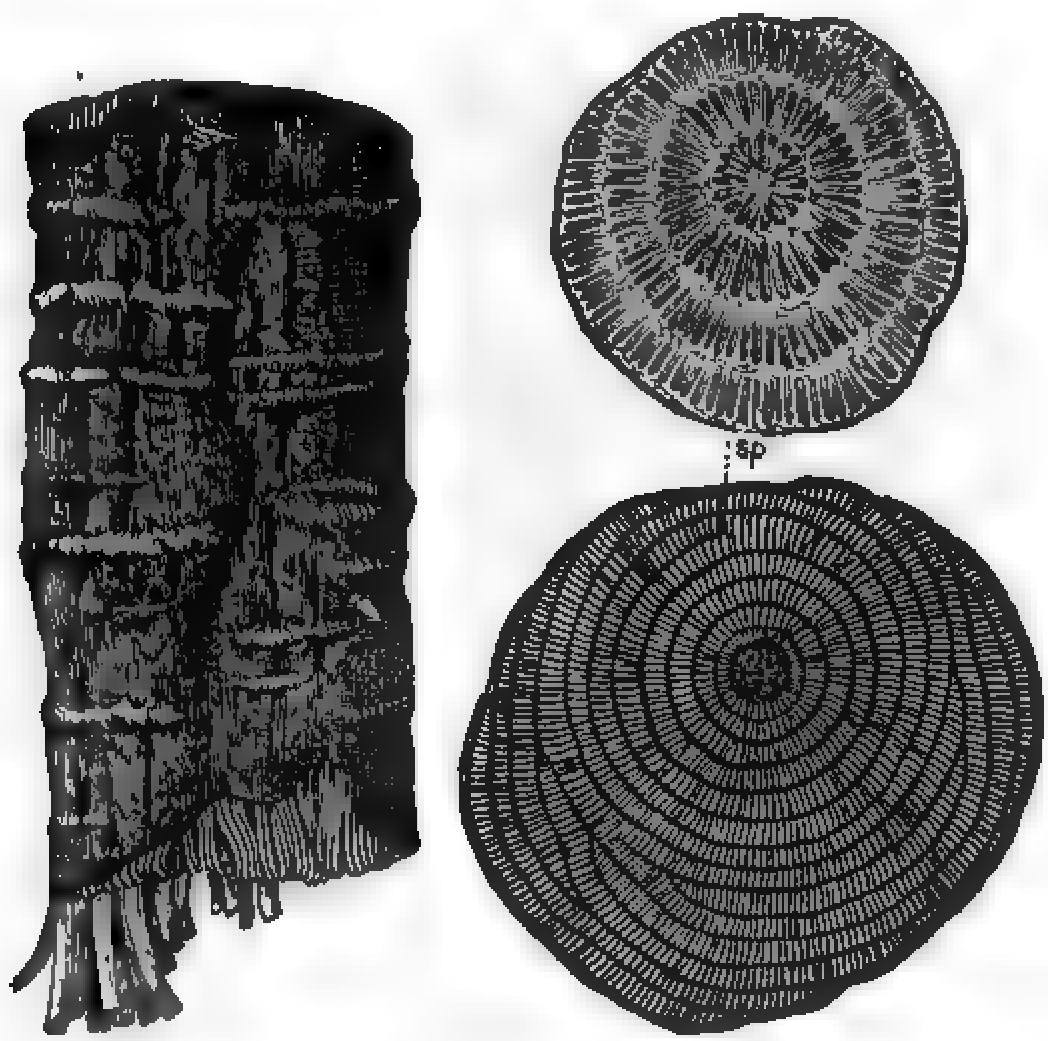


Fig. 120.

that other substances are readily recognized. The most common one of these false pareiras comes in heavy pieces showing the structure as in the lower right-hand drawing (Fig. 120); it is interesting mainly on account of the spurious rings, or sometimes even spirals *(sp)*, which are sometimes found in woods of tropical growth. Pieces of pareira having a bright yellow color, or the woody portion of which is grayish, hard and nearly tasteless, should be rejected.

Glycyrrhiza

N. Liquorice root.—**O.** Root of *Glycyrrhiza glabra* and *G. glabra,* var. *glandulifera; Leguminosæ.*—**H.** Native in Southern Europe and Western Asia, and cultivated in England, France and Germany.—**D.** Cylindrical, tough, pliable pieces, up to one meter long, and from five to twenty-five millimeters thick; externally grayish-brown, warty, and with longitudinal wrinkles; internally yellowish; with thin bark in the thicker pieces but proportionately

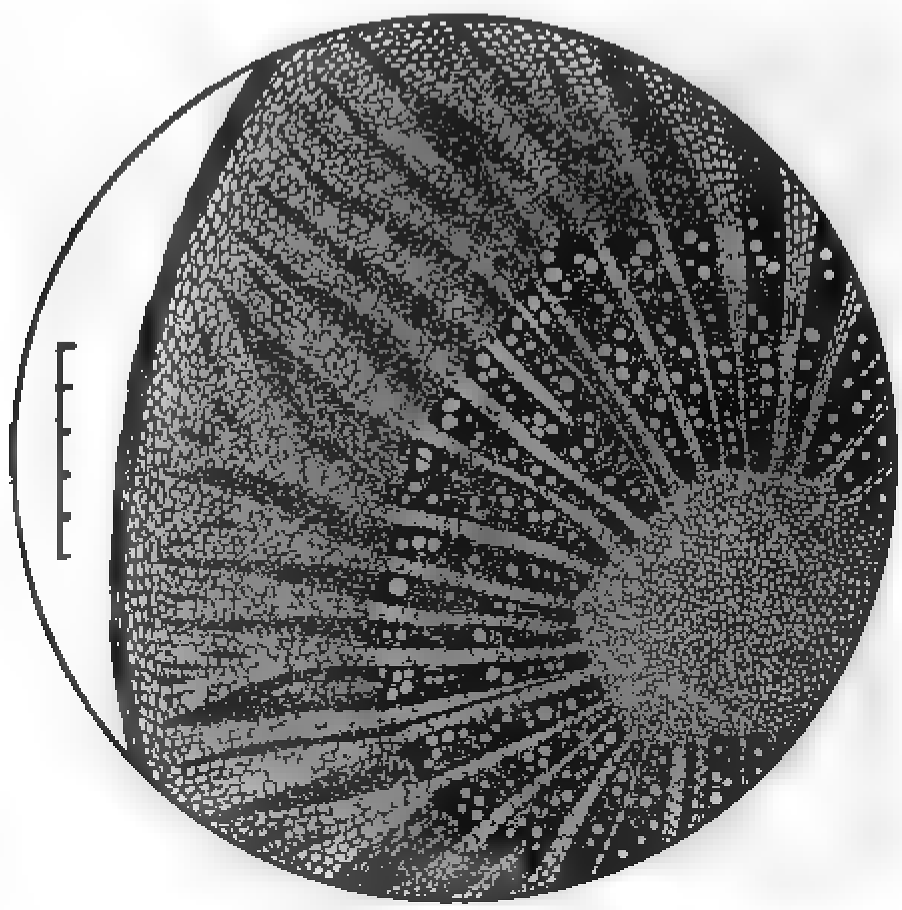


Fig. 121.

thick bark in thin pieces, no pith, wood in narrow bundles, and medullary rays linear, both bast and medullary wedges extending through the greater part of the bark; nearly inodorous; taste sweet, mucilaginous and somewhat acrid. In the stolons or underground stems which are sometimes present, there is a thin pith.—**C.** About six per cent of the peculiar principle glycyrrhizin, considered to be an ammonium salt with glycyrrhizic acid.—**U.** Expectorant and demulcent; mainly used as an excipient to mask the unpleasant tastes of other substances. **Dose:** Ad libitum.

Fig. 121 shows a segment of a section in the field of vision of the microscope, enlarged at the rate indicated by the scale which shows one millimeter divided into fifths of a millimeter. The piece from which this section was made was therefore a quite small one, and the bark was comparatively thick; the relation of the different parts to each other is clearly shown, as well as the peculiarity that growth is often excentric.

Spanish, Italian, German and Turkish liquorice roots are all obtained from *G. glabra,* and correspond to the above description. The retail pharmacist generally buys the root cut in regular straight lengths and tied in bundles with wires, the crooked pieces and cut ends being consumed in manufacture.

The Russian liquorice root (from *G. gl.* var. *glandulifera,* or *G. echinata)* is in thicker pieces, paler yellow color and often with the corky layer removed by scraping; it has a less sweet taste, sometimes even having a bitter by-taste. It makes a fine looking powder, but it is inferior to the other variety for all other purposes for which liquorice root is employed.

Only a very small proportion of all the liquorice root imported is used in pharmacy, the bulk being consumed in the manufacture of chewing tobacco.

Gelsemium

N. Gelsemium, Yellow Jasmine.—**O.** The rhizomes and roots of *Gelsemium sempervirens; Loganiaceæ.*—**H.** Southern United States.—**D.** Thick, branched rhizomes and roots, cut into short lengths and irregular pieces, which are sometimes split, mostly from five to fifteen millimeters thick, but occasionally to three or even more centimeters thick; the rhizomes are thicker than the roots, but being cut they are not readily recognizable as rhizomes and the drug is for this reason classed under Roots; externally light yellowish-brown, with purplish longitudinal lines and furrows and occasional transverse fissures; internally pale yellowish; bark closely adherent to the wood, thin, with silky bast fibers; wood porous, tough, breaking with a splintery fracture, and showing lighter colored radiating medullary rays; the rhizome has a thin pith, the roots have none; odor feeble, somewhat narcotic; taste bitterish. The drawing (Fig. 122) shows a

large piece of root in natural size, and the section is that of a small root examined by reflected light after soaking, and magnified five diameters. The furrows in the dry roots are caused by a shrinkage of the bark, determined by the bundles within, and the purplish color is due to the color of the external layers of

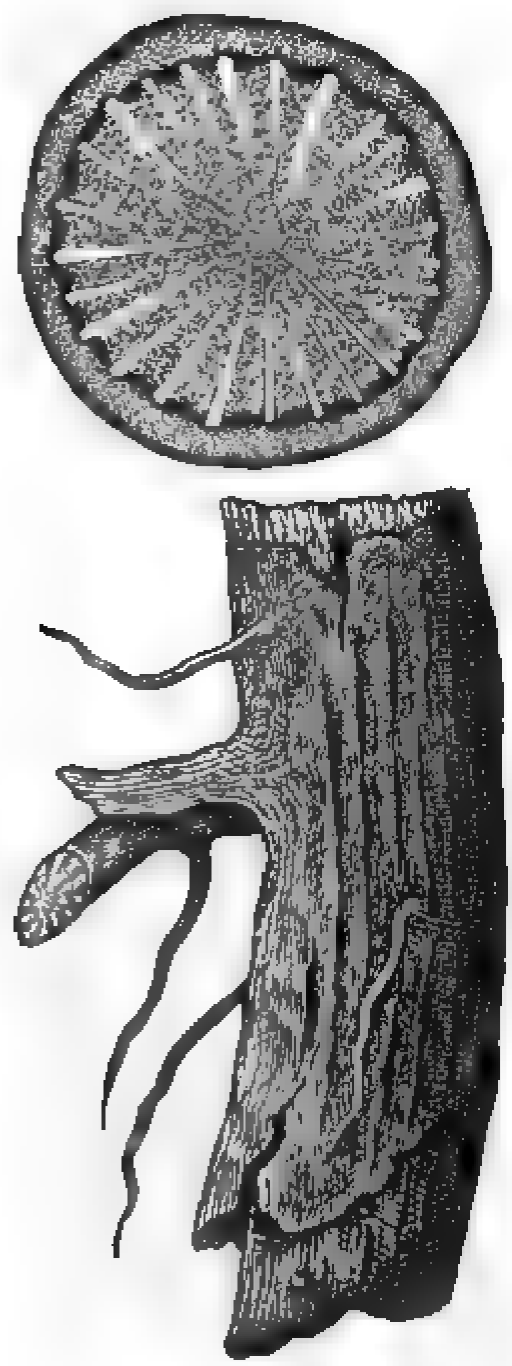


Fig. 122.

cork which have that color, and which remain in the depression of the furrows but are apt to be rubbed off elsewhere.—**C.** An alkaloid, gelsemine.—**U.** Mainly in nerve affections of a neuralgic character; also as a depressant and sedative. Dose: 0.1 to 0.5 gram, in tincture or fluid extract.

In over-doses gelsemium is poisonous; antidotal treatment consists in prompt evacuation of the stomach, the administration of diffusible stimulants, application of artificial warmth, electricity and artificial respiration. Digitalis and belladonna are physiological antidotes.

Methysticum

N. Kava, Ava Kava, Kava Kava.—**O.** Roots of *Piper Methysticum; Piperaceæ.*—**H.** Sandwich and other Pacific Islands.—**D.** Large, more or less spongy roots, sometimes cut in pieces, gen-

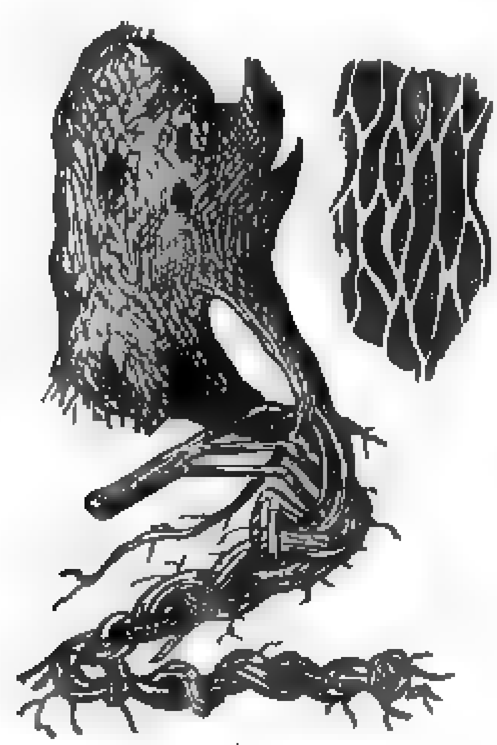


Fig. 123.

erally with branches, the latter often braided and sometimes separate from the large roots; grayish-brown externally, internally pale-yellowish, or yellowish-white; bark thin, often chipped off in flakes showing a characteristic network of yellowish-white bundles underneath, as shown in the drawing to the right; porous, frequently hollow, sometimes worm-eaten; odor somewhat fragrant; taste pungent, slightly aromatic, astringent and bitter.

Fig. 123 shows a root about one-fourth linear size.—**C.** About two per cent resin, some volatile oil, kavahin, etc.—**U.** Stimulant, diuretic, diaphoretic, sialagogue, etc. Dose: 2 to 5 grams, best in fluid extract.

Hydrangea

N. Hydrangea, Seven Barks.—**O.** Roots of *Hydrangea arborescens; Saxifragaceæ.*—**H.** United States, from the lakes southward.—**D.** Irregular, knotty head, two or more centimeters thick, root branches finger-thick or less, much bent and somewhat tuberculous; usually cut into short pieces; thin pale-brown bark

Fig. 124.

which occasionally peels off in spots, exposing the wood; wood white and tough, breaking with a splintery fracture; odor none; taste insipid and sweetish, afterwards somewhat pungent. Hydrangea is shown in natural size in the drawings.—**C.** A crystalline glucoside, resin, etc.—**U.** Lithontriptic. Dose 2 to 5 grams, best in fluid extract.

GROUP XVIII

Woody Roots; Thick Bark with Ducts

In di-cotyledonous or exogenous roots with thick bark the bark is often nearly as thick as the wood from the center outwards, or sometimes even as thick as the whole wood-cylinder. Such roots sometimes have oil, resin or latex ducts, spaces or large cells in the middle bark, and when this is the case they belong to this group. Only three are of any importance; the wood in these is not very firm, but it often is tough and breaks separately from the bark; Maisch calls them fleshy roots.

Long roots, gray bark about one-fourth of diameter of the dry root.................. **Apocynum Cannabinum.**
Similar to above, but thinner, brown, and bark about one-sixth of entire thickness....... **Apocynum Androsæmifolium.**
Short brownish-gray sections, wood spongy and bark easily separable and flaring at cut ends .... **Stillingia.**

Apocynum Cannabinum

N. Apocynum, Canadian Hemp, Black Indian Hemp.—**O.** *Apocynum cannabinum; Apocynaceæ.*—**H.** United States.—**D.** Long, cylindrical, sometimes branched roots, three to twelve millimeters thick, average thickness being about seven millimeters; bark thick, about one-fourth of the diameter of the dried root, or one-third of the diameter of a root after soaking in water; externally gray, sometimes with a faint brownish tint, with blunt longitudinal wrinkles and deep transverse fissures extending through the bark to the wood; in section the bark of small pieces of root is white or lighter in color than the wood, but in old pieces it is darker, even brown and sometimes resinous; wood yellowish, porous, breaking with an abrupt fracture when the drug is thoroughly dry or bending before breaking when not dry; neither pith nor central cavity; inodorous; taste bitter and disagreeable.—**C.** An amorphous resin and a glucoside.—**U.** In small doses diuretic; in larger doses emetico-cathartic; useful for removal of dropsical fluids. Dose: 0.5, even to 2 grams as an emetic, best given in fluid extract.

The drawings in Fig. 125 show two pieces (to the right) of root and a piece (above, to the left) of the stem, all natural size; the stem, which is often present, is brown, has a pith or central cavity, and often shows buds (marked by asterisks); it has no

Fig. 125.

transverse fissures, the bark is thin, wood tough; sometimes it is split lengthwise; the taste is slight.

The drawings of sections show the dry root in section *(a)* in natural size, the root after soaking in water and examined by re-

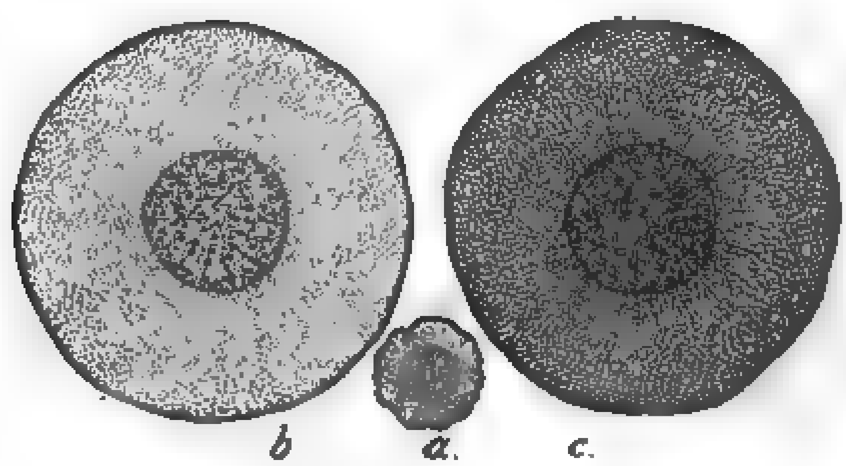


Fig. 126.

flected light, enlarged *(b)*, and a section of the latter after clearing with solution of potassium hydroxide *(c)*, also enlarged, which shows the resin ducts in the bark.

Apocynum Androsæmifolium

H. Bitter Root, Dogs-bane.—**O.** The root of *Apocynum androsæmifolium; Apocynaceæ*.—**H.** United States.—**D.** Rarely exceeding ten centimeters long, and from three to twelve millimeters thick, the average thickness being about four or five millimeters; externally rusty reddish-brown, the thick bark deeply

and sharply wrinkled longitudinally, and with transverse fissures that extend through the bark to the wood; bark about one-sixth the total diameter in the dry root, or nearly one-third the diameter in the soaked root; wood white, porous and brittle, breaking with an abrupt fracture; inodorous; taste very bitter.—**C.** Probably similar to those of *A. cannabinum*.—**U.** Emetico-

Fig. 127.

cathartic, used in hepatic derangements; action probably like that of *A. cannabinum*. Dose: 0.5, even to 2 grams as an emetic, best in fluid extract.

The stem, pieces of which are generally present, is recognized by its large pith or central cavity, its tough wood which is often split lengthwise, and the buds attached; some of the buds are

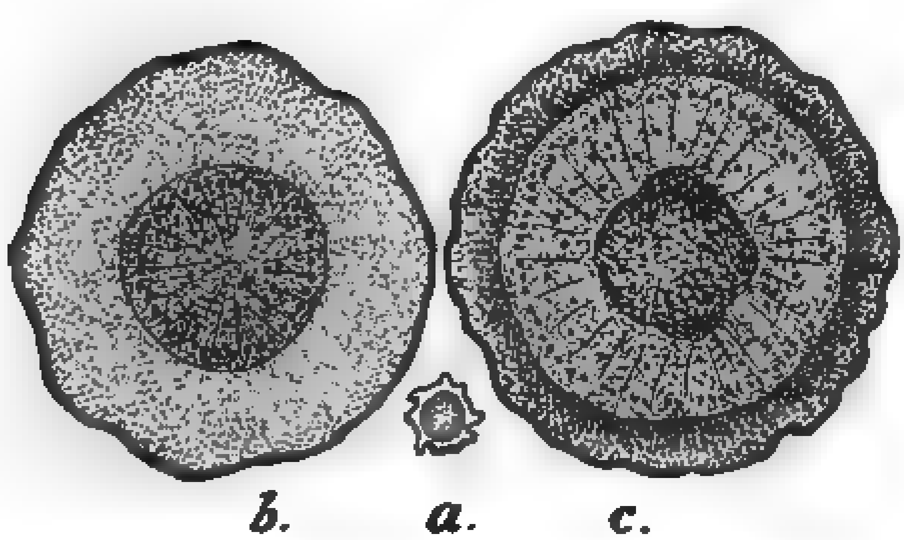


Fig. 128.

marked with asterisks in the drawing. The drawings show stem (upper) and root (lower) in natural size.

In the drawings of sections (Fig. 128) *a* represents that of the dry root; *b* that of a root after being soaked in water, examined with a lens by reflected light; and *c* is a section of stem, also after being soaked, and by reflected light, enlarged.

The two varieties of Apocynum are frequently mixed; the differences are here noted side by side.

A. cannabinum.	*A. androsæmifolium.*
Diameter averages about seven millimeters.	Diameter averages about four to five millimeters, although as large and as small pieces as any of *A. cannabinum* can be found.
Thickness of bark about one-fourth of the entire diameter of the dry drug.	Thickness of bark about one-sixth of the entire diameter of the dry drug.
Externally gray.	Externally reddish-brown.
Vessels in woody portion more or less concentrically arranged.	Vessels less numerous and nearly all in one circle near the outer edge of the wood cylinder, only a few being scattered farther within.

It is probable that the actions of the two drugs are identical, so that a careful differential diagnosis between them is of importance only because of the absolute necessity in medicine of calling each drug by its own proper name, without which no reliable knowledge of pharmaco-dynamics could exist.

Stillingia

N. Stillingia, Queen's Root.—**O.** The root of *Stillingia sylvatica; Euphorbiaceæ*.—**H.** Southern United States.—**D.** The fresh root

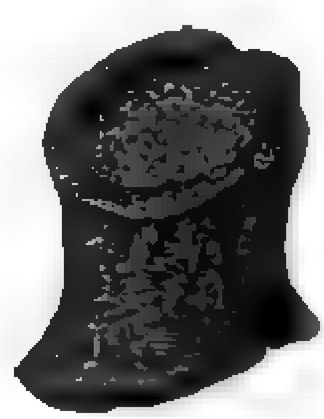


Fig. 129.

is large, thick, tapering, little branched, tough and fibrous. The drug consists of the root chopped into pieces about two to five centimeters long, wrinkled, brownish-gray externally and somewhat lighter colored within; bark thick, with numerous yellow-

ish-brown resin-cells, and but few bast fibers, and a soft, porous, although fibrous wood; in drying the bark shrinks lengthwise so that it flares at the cut ends and often separates partly or completely from the slightly projecting wood, although the latter usually remains inclosed; taste bitter, acrid and pungent, and odor peculiar and disagreeable.—**C.** Resin and probably a glucoside (or alkaloid?); no full analysis has been made.—**U.** Alterative. Dose: 1 to 2 grams.

GROUP XIX

Differs from the last group in the roots having no oil, resin or latex ducts, spaces or large cells.

Purplish-brown, wood tough, bark thick........................**Krameria**
Small roots, blackish-brown, with thick annular bark..........**Ipecacuanha**
Grayish-brown to dark brown, more or less contorted.**Cartagena Ipecacuanha**

Krameria

The bark of *Krameria Ixina* belongs in this group, but it has already been described in connection with Peruvian Rhatany, under Group XVII, to which the reader is referred.

Ipecacuanha

N. *Ipecacuanha, Ipecac;* known in the trade as Brazilian or Rio Ipecac.—**O.** The roots of *Cephaelis Ipecacuanha; Rubiaceæ.*—**H.** Brazil.—**D.** The roots come into trade in pieces up to ten centimeters long, and from four to five millimeters thick; seldom branched, often contorted; externally grayish-brown or blackish; bark thick, closely and irregularly annulated and often transversely fissured, giving the drug the appearance as in the drawing, which is natural size; bark easily separable from the thin, tough, whitish wood cylinder; odor peculiar, nauseous, but slight, and taste bitterish, acrid and nauseating.—**C.** Emetine. and Cephaëline; the drug should not contain less than 1.75 per cent ether-soluble alkaloids.—**U.** In large doses emetic, in small doses expectorant and diaphoretic. Dose: 0.03 to 0.05 gram; as an emetic 1 to 2 grams.

Stems, which are sometimes admixed, may be recognized by the thin and smooth bark which is not annulated. Good ipecac consists of about eighty per cent of bark by weight. When ipecac is sound and free from mouldiness, its quality is proportionate to the thickness of the bark and the thinness of the ligneous portion. The illustrations (Fig. 130) show good ipecac, whole, and a section of same magnified at the rate shown by the scale which is one millimeter divided into fifths. It is difficult to clear the cells of their contents, so that most of them remain filled with altered cell-contents, even after quite long maceration in the clearing solutions.

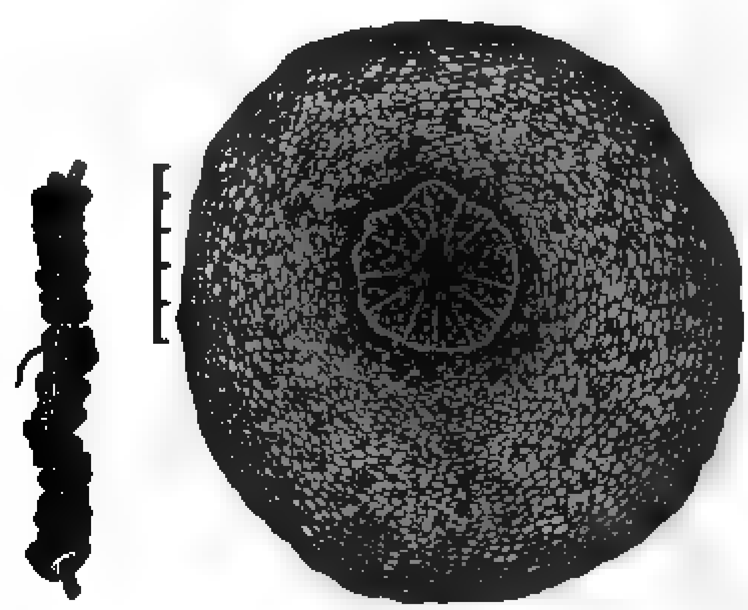


Fig. 130.

The books mention various spurious ipecacs, but as they are not found in our markets, it is not necessary to mention them here.

Cartegena Ipecac is obtained from *Cephaëlis Acuminata; Rubiaceæ.* It occurs in cylindrical or somewhat fusiform, more or less contorted pieces, up to 12 cm. in length and from 4 to 7 mm. in thickness; grayish-brown; not as markedly annulate as Rio Ipecac; bark about 2 mm. thick, dark-brown, and easily separated from the light-brown wood; stems up to 10 cm. long and 2 to 3 mm. thick, cylindrical somewhat zig-zag, grayish-brown externally with bark thin and longitudinally wrinkled.—**C.** and **U.** like those of Rio Ipecac.

FLESHY ROOTS

In fleshy roots the fibro-vascular bundles are either small and widely separated so that there is no wood-cylinder, or the prosenchyma of the bundles is little or not at all lignified, so that although there may appear to be a wood-cylinder and cambium zone, all the tissues are of nearly the same degree of softness, and so intimately united that the bark will not separate from the wood on drying or in the fresh condition; there is, however, no rigid demarcation between woody and fleshy roots, so that roots which are classed as fleshy by some authors are classed as woody by others. Besides, just as in radishes a younger root may be succulent and tender, and an older root be hard and woody and unfit for eating, so, in drugs, the age of the gathered root may also determine its degree of woodiness. However, there is one characteristic which we can use as a distinguishing feature, that in woody roots the bark sometimes separates from the wood while in fleshy roots it does not.

Owing to the fact that fleshy roots are made up mainly of succulent parenchyma, which decreases very much in bulk on drying and the further fact that the longitudinal bundles offer more resistance to contraction during drying than is offered to contraction in the transverse direction, most fleshy roots show deep longitudinal wrinkles, although some also show less marked transverse wrinkles. The cambium zone, consisting of more delicate cells, often oxidizes readily and becomes darker-colored than the other tissues, especially in fleshy roots that are cut into sections before drying, and thus it forms a dark line which sometimes becomes a diagnostic feature. Similarly, drying may cause a marked contrast between the colors of the wood rays and medullary rays, sometimes the one, sometimes the other being the darker-colored, and this, too, is of value in recognizing the individual drugs.

We divide fleshy roots into two groups. Group XX, consisting of fleshy roots with latex, oil or resin ducts, cells or spaces, and Group XXI, fleshy roots without such ducts.

GROUP XX

Fleshy Roots with Ducts

The oil, resin or latex ducts, spaces or large cells referred to are mainly found in the parenchyma of the inner and middle bark; sometimes also in the inner parts of the root, or in the bast portion of the fibro-vascular bundles, or in the medullary rays and pith.

Hard, tuberous, irregularly round or pear-shaped, dark brown.. **Jalapa.**
With caudex, branched, section marked with concentric lines.. **Taraxacum.**
With caudex, branched, section marked with radiating lines.. **Cichorium.**
Hard, yellowish-brown or gray, bark closely tuberculated.... **Asclepias.**
Tough, porous sections with irregular bundles................ **Sumbul.**
Light grayish-brown, branched root, deeply wrinkled........ **Angelica.**
Fusiform, yellowish, annulate, often bifid.................. **Panax.**
Fusiform, dark grayish-brown, annulate above, deeply wrinkled .... **Pyrethrum.**
Thick, round root with long branches, or sometimes in transverse or longitudinal sections.......................... **Inula.**
Long, spongy or flexible, light-colored, usually split lengthwise. **Levisticum.**
Dark brown, knotty, flattened, with root-scars and transverse rings .... **Imperatoria.**
Long, slender, yellowish-white, flexible, usually split lengthwise .... **Petroselinum.**
Long, yellowish-brown, annulate above, wrinkled and warty below .... **Pimpinella.**

Jalapa.

N. Jalap.—**O.** The tuberous root of *Ipomœa Jalapa (Exogonium purga); Convolvulaceæ.*—**H.** Mexico.—**D.** Irregularly rounded, ovate or pear-shaped, as in the drawing, more or less deeply wrinkled and the larger roots incised, dark brown with lighter-colored transverse warts or ridges, very hard and compact, breaking with an abrupt, horny and somewhat resinous fracture; internally pale grayish-brown; consists mainly of starchy parenchyma with large resin-cells arranged in a dense layer under the thin bark and in wavy concentric circles which are darker than the starch-containing portions, as shown in the drawing of a section; taste sweetish, acrid and disagreeable and odor sweetish and nauseous.—**C.** Not less than 7 per cent of resin of which not over one-tenth should be soluble in ether. Formerly jalap yield-

ing 12 to 20 per cent of resin was not unusual, but more careless modes of gathering have reduced the grade of available drug.—U. Hydragogue cathartic. Dose: 0.5 to 1.5 grams. Jalap is said to come into the market occasionally in longitudinal or transverse slices, but this is certainly quite rarely the case.

Jalap must be sound, heavy and hard; soft and sticky, or mealy and light-colored, or woody tubers should be rejected. False jalaps are excluded by the description just given. Tampico Jalap resembles true jalap, but is of more irregular form without the transverse ridges or warts, light in weight, shriveled, and con-

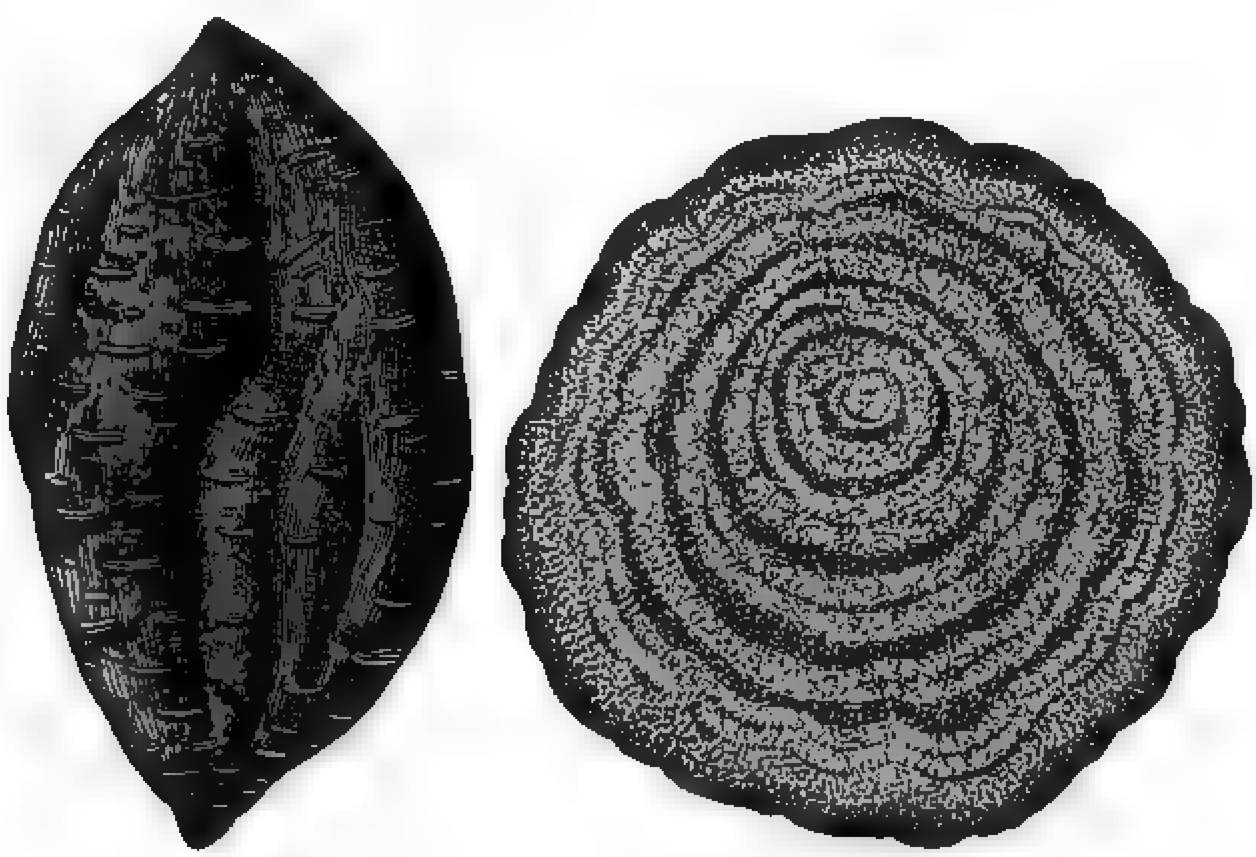


Fig. 131.

tains a resin which is almost entirely soluble in ether. Male Jalap is spindle-shaped, light and woody, with a resin that is wholly soluble in ether. Mechoaccan Jalap usually comes cut into slices or cubes, and is light-colored or almost whitish, mealy and with very little resin.

Genuine jalap is sometimes deprived of its resin by maceration in a solvent, and then dried; such jalap is darker-colored throughout, more wrinkled, and more or less glossy externally. Worm-eaten jalap is unfit for all purposes but making resin of jalap, for which latter purpose it is still valuable, because the insects

which attack it destroy only the cells containing starch, so that the more worm-eaten the drug, the greater will be the proportionate yield of resin.

Taraxacum

N. Dandelion.—**O.** Root of *Taraxacum officinale* gathered in autumn; *Compositæ*.—**H.** Europe and United States.—**D.** The drug consists of a several-headed caudex with a cylindrical or somewhat tapering and slightly branched root, ten to fifteen centimeters long and up to ten millimeters thick and with the caudex sometimes up to twenty-five millimeters in diameter; usually

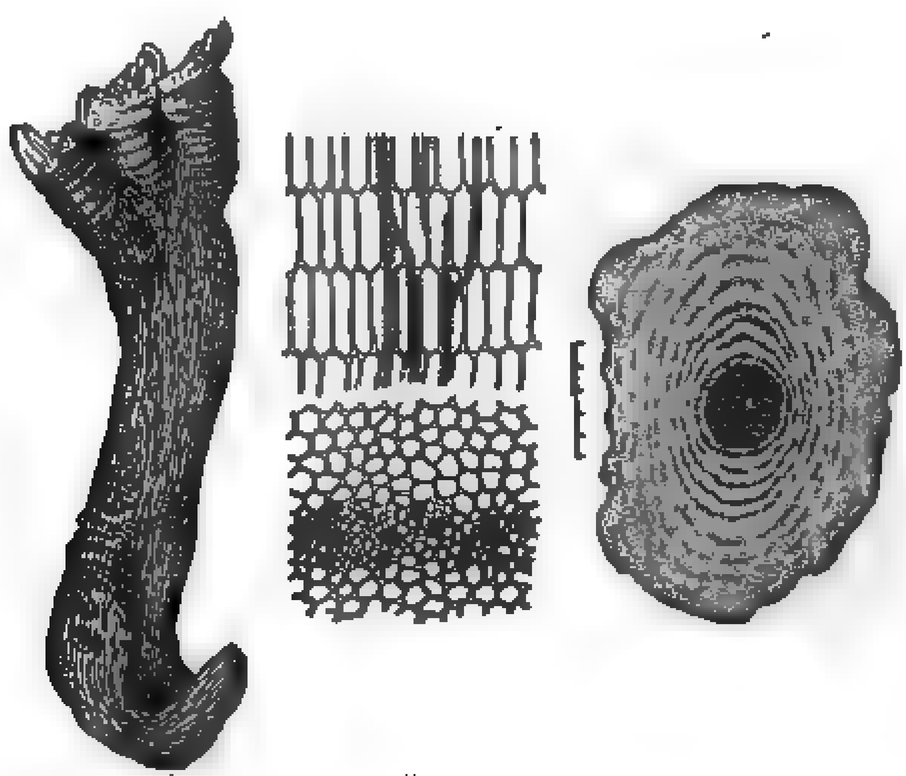


Fig. 132.

much shrunken and with deep longitudinal wrinkles; externally dark brown and internally light gray or whitish; fracture abrupt, brittle, and somewhat resinous, showing a thin yellowish central wood-cylinder, consisting of reticulated and dotted ducts, non-lignified prosenchyma and parenchyma, and a thick whitish bark marked with numerous grayish-brown circles of latex ducts; little or no odor, and a sweetish-bitter and mucilaginous taste.—**C.** Taraxacin, etc.—**U.** Bitter tonic, alterative, and cholagogue. Dose: 2 to 10 grams.

Dandelion is frequently much discolored, damaged by insects, mouldy or otherwise worthless. It should be perfectly

sound and recently dried to be of best value. Many lots of dandelion consist of small and apparently immature roots, having but little resemblance to dandelion as it should appear, but even in these roots the concentric markings are very plain; the section is drawn from a medium-sized root, the scale being one millimeter divided into fifths. The two drawings of cells show the parenchyma and laticiferous ducts in longitudinal and transverse sections.

Chicory (Cichorium, from *Cichorium Intybus; Compositæ)* is sometimes substituted for or added to dandelion, which it very closely resembles in its outward appearance; the transverse section, however offers a ready means for distinguishing between the two drugs, chicory having the laticiferous vessels arranged in radiating lines in the bark, instead of in concentric circles, as in dandelion.

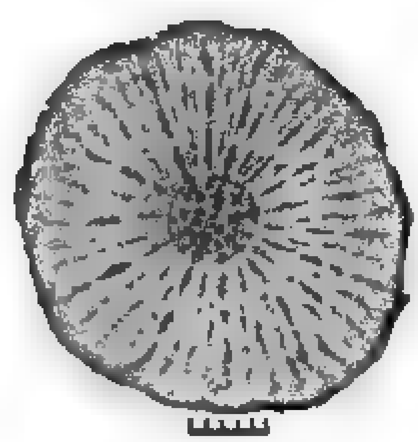


Fig. 133.

Only the wild-grown chicory is used as a substitute for dandelion, and it is generally lighter-colored than dandelion; the cultivated chicory, which is used as an adulterant or a substitute for coffee, etc., is shorter and more plump than dandelion and not easily mistaken for it. The scale is the same as in dandelion.

Asclepias

N. Asclepias; Pleurisy Root.—**O.** The root of *Asclepias tuberosa; Asclepiadaceæ.*—**H.** United States, near Atlantic Coast.—**D.** Large, cylindrical, sometimes spindle-shaped roots, usually cut into lengths of from five to fifteen centimeters, and two or more centimeters thick; externally orange-brown when fresh, gray when old, internally whitish; breaks with a tough and uneven

fracture showing the bark in two-layers; the external bark nodulated in a peculiar manner, as shown in the drawing, affording a diagnostic feature, the inner bark thin, whitish and with but few ducts, and the wood porous, yellowish, and with

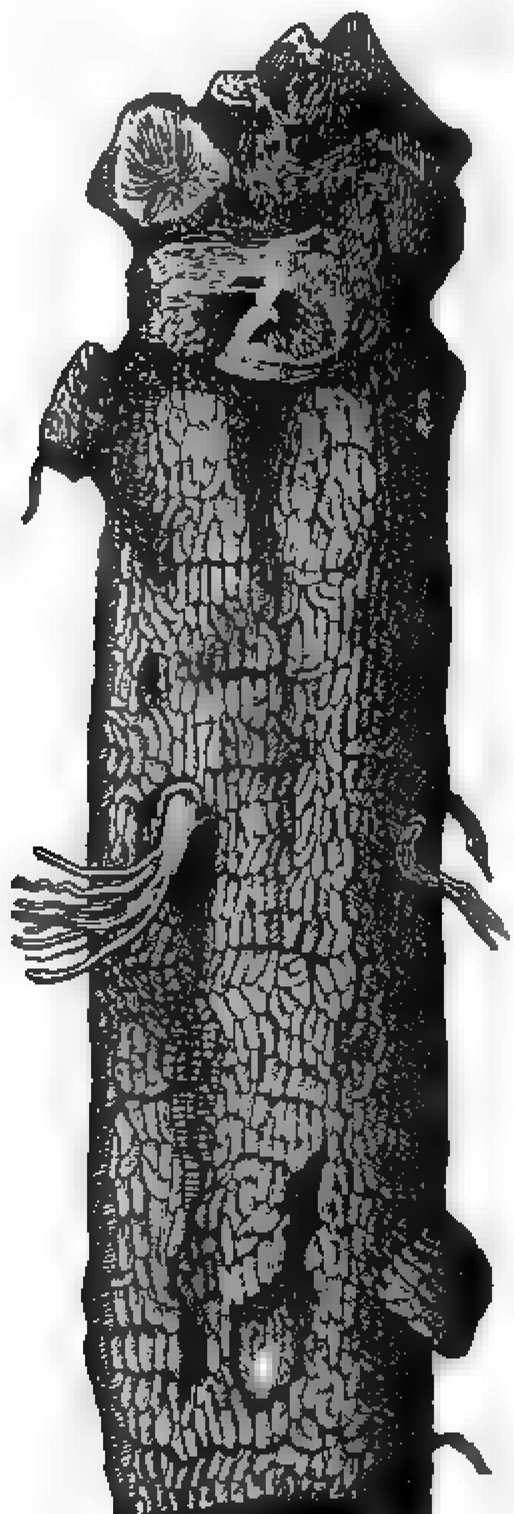


Fig. 134.

wide medullary rays; taste bitterish and somewhat acrid, odor none.—C. Two resins, fixed and volatile oils, etc.—U. Diaphoretic, expectorant and carminative. Dose: Two to five grams, several times a day.

Sumbul

N. Musk Root.—**O.** The root of *Ferula Sumbul; Umbelliferæ.*—**H.** Central and Northeastern Asia.—**D.** Transverse segments of a light, spongy root, from two to ten centimeters thick and two to three centimeters long; externally dark brown, annulate and sometimes deeply wrinkled longitudinally, and internally whitish, with yellowish-brown dots and tangled fibers; taste bitter and balsamic, and odor musk-like.—**C.** Volatile oil, balsamic resin, etc.—**U.** Stimulant, blennorrhetic, and nervine tonic. Dose: 0.5 to 2 grams. In the East it is also used as perfume and incense.

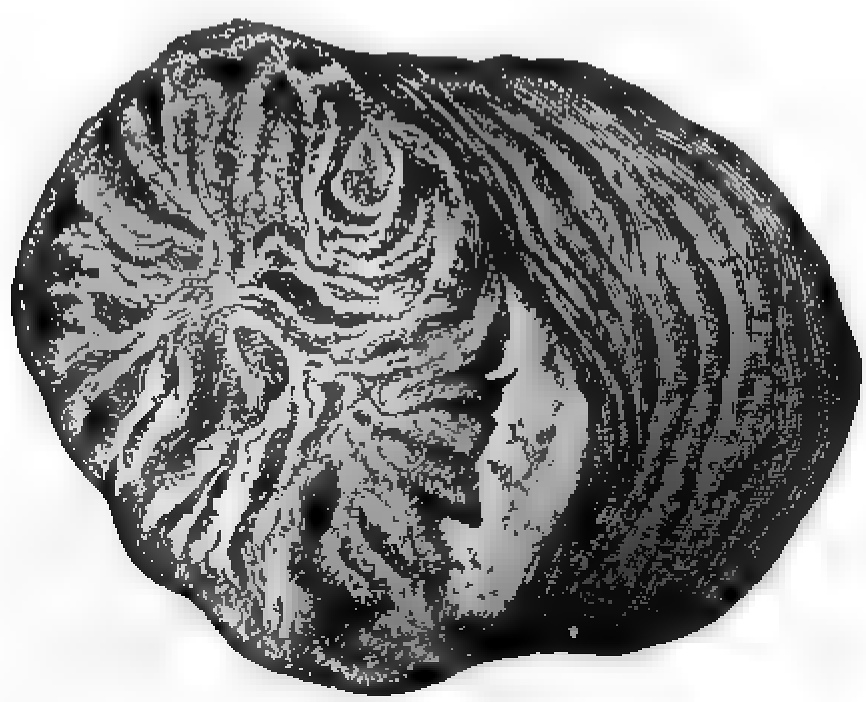


Fig. 135.

The dark markings on the cut ends are due mainly to adhering dirt rubbed off from the outer parts; the illustration shows a portion broken away, exposing the clean, whitish tissue within.

Angelica

N. Angelica Root.—**O.** The root of *Archangelica officinalis,* collected in the autumn of the first year; *Umbelliferæ.*—H. Central and Northern Europe and Asia.—**D.** Root five to ten centimeters long and two to five centimeters thick; the upper end somewhat annulate and with leaf remnants attached; below divided into a number of almost cylindrical deeply wrinkled branches; externally grayish-brown; breaks with a short, spongy fracture,

showing a thick whitish bark with radiating lines of large resin ducts in the bast portions of the bundles, and a yellowish porous wood. The illustration shows a root in natural size. The drug

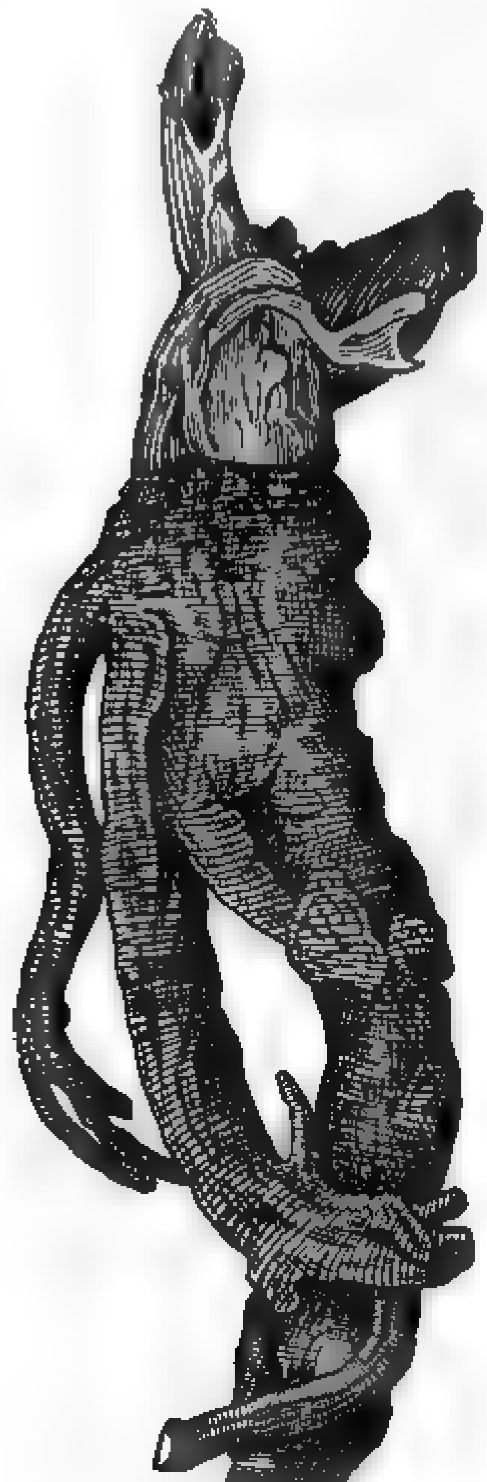


Fig. 136.

should not be so dry as to be brittle.—**C.** Volatile oil, resin, etc.—**U.** Aromatic, stimulant and carminative. Dose: 1 to 5 grams.

Panax

N. Ginseng.—**O.** The root of *Panax quinquefolius; Araliaceæ.*—**H.** North America south to the mountains of Tennessee and Geor-

gia.—**D.** Spindle-shaped, five to ten centimeters long, often bifid or with three branches, annulate and longitudinally wrinkled; pale yellowish-brown externally, white and mealy within; breaks with a short fracture, showing thick bark which contains numerous resin cells; taste sweetish and aromatic and odor faint. Ow-

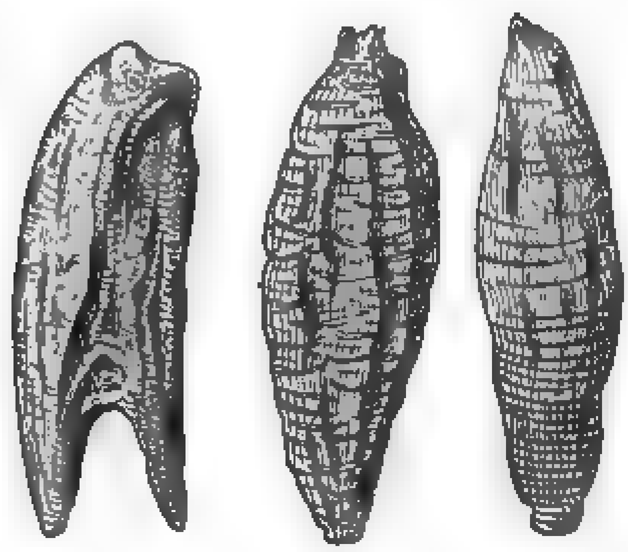


Fig. 137.

ing to the high price of ginseng, it is often gathered before fully grown, and small specimens like those illustrated are therefore most common.—**C.** A sweet amorphous substance which has been named panaquilon, resin, etc.—**U.** Stimulant tonic; gathered mainly for export to China, where it is highly prized as an aphrodisiac. Dose: 2 to 5 grams.

Pyrethrum

N. Pellitory, Roman Pellitory.—**O.** The root of *Anacyclus Pyrethrum; Compositæ.*—**H.** Africa, adjacent to Mediterranean Sea;

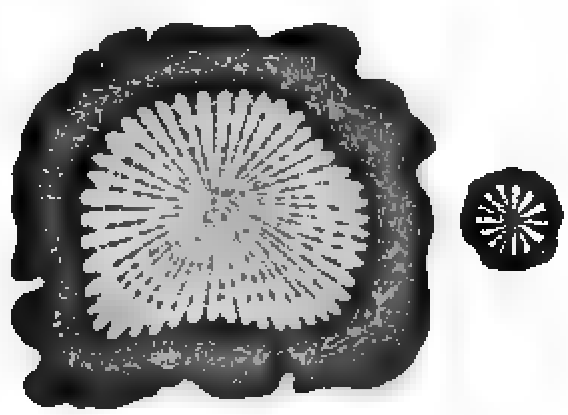


Fig. 138.

comes into trade mainly from Tunis through Italy.—**D.** Fleshy, simple, fusiform root, from five to ten cm. long and from five

to twenty mm. thick, the upper end annulate and sometimes with frayed remnants of leaves and stem; deeply wrinkled and dark brown externally and grayish-white internally; with abrupt fracture showing comparatively thin bark, the outer layer of the middle bark containing comparatively few but large resin ducts; narrow yellowish wood-bundles and wider and darker-colored medullary rays, as shown in the larger drawing of a section of a dry root, magnified three diameters; odorless, but with an acrid and pungent taste.—**C.** Acrid resin and fixed oil, etc.—**U.** Irritant, sialagogue, etc. Dose: 2 to 5 grams.

German Pellitory consists of the roots of *Anacyclus officinarum*, which are simple, nearly straight and filiform, up to fifteen cm. long and two to three mm. thick, with frayed leaf and stem remnants, deeply wrinkled, dark-brown externally, lighter brown within, with abrupt fracture, showing two layers separated by a darker-colored cambium zone and with numerous resin ducts in the bast portion; taste, odor, constituents and uses similar to those of Roman Pellitory. The drawings of the sections are after Berg, the smaller showing German Pellitory, also magnified three diameters.

Inula

N. Inula, Elecampane.—**O.** The root of *Inula Helenium; Compositæ*.—**H.** Central and Southern Europe; naturalized and cultivated in the United States.—**D.** It is usually described as being in transverse or longitudinal sections, the latter with overlapping bark, as shown in the crescent-shaped section (after Maisch); I have more frequently found it whole, or at most, cut into two or three pieces and rarely longitudinally sliced, so that the "overlapping bark" is seldom to be seen. The drug, as I have seen it in trade, is shown in natural size in the drawing; it is a fleshy root, about two to three cm. thick at the upper end and from five to twenty-five cm. long, sometimes whole but often cut into two or three pieces, the figure showing the upper end which is most characteristic; this end is marked with a cup or funnel-shaped stem-scar and with several more or less fusiform heads, each having a similar depression. The root either tapers gradually to a thin end or it may end rather abruptly in several branches, which are generally cut off and come as separate pieces;

the lower root-ends or branches taper from about ten mm. to a point and are from five to fifteen cm. long, either simple or slightly branched, deeply wrinkled longitudinally, flexible in damp weather, but hard when dry when they break with an abrupt fracture; the cut and dried ends of larger pieces show projecting concentric and radial lines, while the smaller roots have the structure as shown enlarged in the figure of a whole section; very rarely a piece may show a tendency to separate at the cambium zone, which, if more frequent, would make this a woody root; externally all parts of the drug, including the cut sur-

Fig. 139.

faces, are of a grayish-brown color, but when broken, the interior appears grayish-white with the resin ducts showing as bright yellow, glistening points in the middle and inner bark, and in the medullary rays and pith; the odor is faintly aromatic and the taste is bitter and pungent.—**C.** Resin, extractive, etc., but no starch.—**U.** Stimulant, expectorant, diaphoretic and diuretic. Dose: 2 to 10 grams.

Levisticum.

N. Lovage.—**O.** The root of *Levisticum officinale: Umbelliferæ.*—**H.** Southern and Central Europe; cultivated in Germany.—**D.** A fleshy root, eight to twenty cm. long and up to three to four cm. thick, several-headed, annulated at the upper end and divided below into several nearly cylindrical flexible branches which are about three to six mm. thick, but usually split longitudinally

into halves or quarters; deeply wrinkled longitudinally; yellowish-brown to dark-brown externally and pale-yellowish internally; fracture spongy, showing a thick bark with many resin ducts and with radiating fissures, and the yellow wood-bundles alternating with narrow white medullary rays which also con-

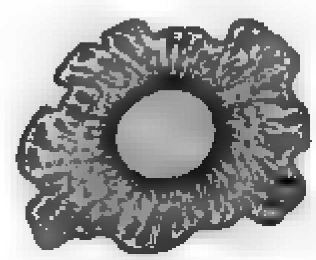


Fig. 140.

tain resin ducts; the main root has a pith; odor strong and penetrating and taste sweetish, mucilaginous and acrid. The drawing is after Berg and shows a section of a dry root enlarged three diameters.—**C.** Resin, volatile oil, bitter extractive, etc.—**U.** Stimulant carminative and emmenagogue. Dose: 0.5 to 2 grams.

Imperatoria

N. Masterwort.—**O.** The root of *Imperatoria* (or *Peucedanum*) *Ostruthium; Umbelliferæ*.—**H.** Southern and Central Europe.—

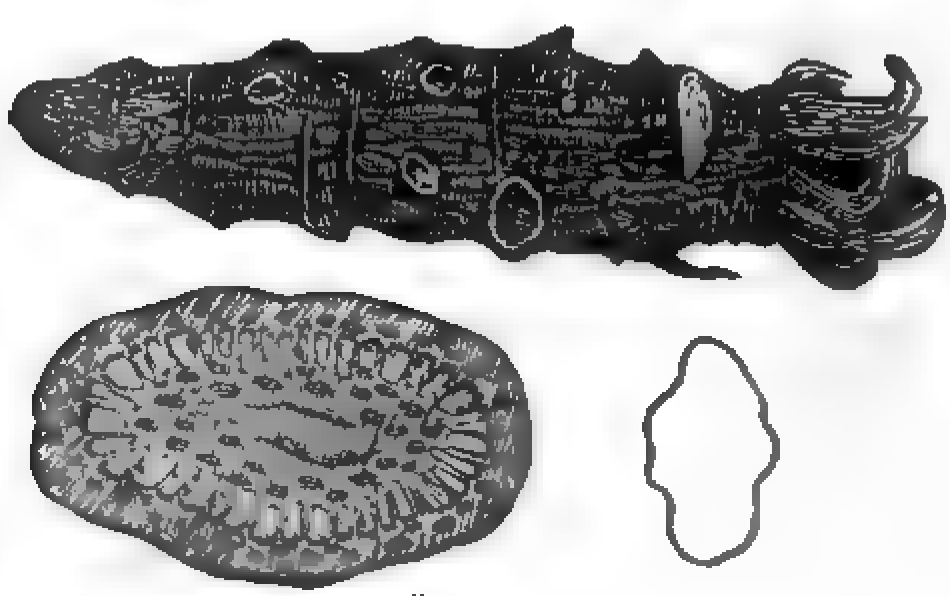


Fig. 141

D. Masterwort is sometimes classed as a root, sometimes as a rhizome; the upper end is a root stock from which branches proceed in the living plant at the ends of which buds and new plants

are formed, but usually this is but a small part of each piece while much the larger part is root; but the rhizome portion may constitute so large a proportion of some pieces that they would be pronounced to be rhizomes and this drug is therefore also enumerated among rhizomes (Group XXIX). The illustration gives a good idea of the appearance and size of the drug; it is knotty, somewhat conical, crowned with leaf remnants, flattened as seen in the outline of its section (natural size), marked with transverse rings and longitudinal wrinkles and tuberculous root-scars; from five to seven cm. long and about fifteen to thirty mm. wide; the enlarged section shows a circle of numerous small wood-bundles inclosing a large pith, and with numerous large resin ducts in the bark and pith; the color is grayish-brown to blackish-gray externally and brownish-yellow to whitish within; odor aromatic and taste pungent and bitter.—**C.** Volatile oil, resin, imperatorin, etc.—**U.** Aromatic stimulant and carminative; seldom used. Dose: 1 to 2 grams.

Petroselinum.

N. Parsley Root.—**O.** The root of *Petroselinum sativum; Umbelliferæ.*—**H.** Southern Europe; cultivated in this country.—**D.** A tapering fleshy root, about fifteen cm. long and about twelve mm. thick; annulate and transversely wrinkled above and deeply wrinkled longitudinally below; wood light-yellow and porous,

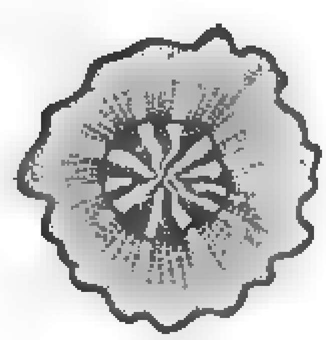


Fig 142

and radiate from the white medullary rays, the bark whitish and dotted with resin ducts; color externally brownish-yellow and whitish within; odor aromatic and taste peculiar and sweetish. The drug usually consists of the root cut into longitudinal strips, which are pale yellowish-white and flexible. The drawing is after Maisch, and shows a section of a root enlarged three diam-

eters.—**C.** Volatile oil, etc.—**U.** Carminative and diuretic. **Dose:** 2 to 5 grams.

Pimpinella

N. Pimpernel.—**O.** The root of *Pimpinella Saxifraga; Umbelliferæ.*—**H.** Central Europe.—**D.** A simple fleshy root, sometimes several-headed, the heads with remains of hollow stems; from ten to fifteen cm. long and five to fifteen mm. thick; the upper end of the root annulate, the lower part tuberculate or warty, and the whole deeply furrowed longitudinally; yellowish-brown or ochre-colored externally; fracture short, abrupt, showing a thick

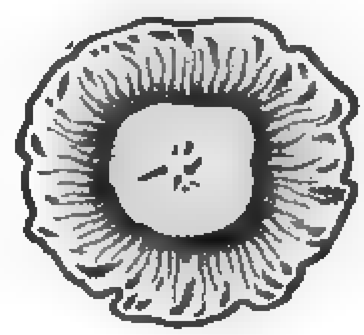


Fig. 143.

white bark with radiating lines of yellowish or reddish resin ducts, separated by a darker-colored cambium zone from the faintly radiate yellowish wood; in old pieces the bark is often torn and fissured within on drying, so that it feels spongy; odor peculiar, aromatic and somewhat nauseous, and taste pungent and acrid. The drawing of the section is after Berg, and shows a section of a dry root enlarged three diameters.—**C.** Volatile oil, resin, etc.—**U.** Stimulant and sialagogue. **Dose:** 0.5 to 5 grams.

GROUP XXI

This group consists of fleshy roots with structure similar to those of the last group, but without the ducts.

Conical, blackish-brown, tuberous roots, single or joined in pairs	**Aconitum.**
Slender, light grayish-brown roots, little branched	**Belladonnæ Radix.**
Large, round or plano-convex orange-yellow pieces of roots, peeled	**Rheum.**
Whole, or longitudinally split, dark brown roots, transversely annulate above	**Gentiana.**

Several-headed caudex, root branched and keeled, yellowish-gray, wood not cylindrical.......................**Senega.**
Transverse sections, greenish-gray bark, yellowish on cut surfaces ....**Calumba.**
Grayish-white transverse sections, hard, with prominent radiating and concentric lines......................**Bryonia.**
White roots with cork removed, externally white, mealy and fibrous.......................................**Althaea.**
Longitudinal and transverse sections, with projecting white wood-bundles alternating with yellowish-gray parenchyma ....**Phytolaccæ Radix**
Long, simple, fusiform root, usually partially broken and doubled up lengthwise..............................**Rumex.**
Brown-black, horny, somewhat contorted roots, often split lengthwise ....**Symphytum.**
Long, thin roots, externally rust-brown, internally whitish ....**Saponaria.**
Cylindrical, simple, fleshy root, grayish-brown and wrinkled ....**Lappa.**
Crowned with leaf bases and covered with a dark purplish foliaceous bark easily separable from the yellowish wood ....**Alkanna.**
Longitudinal or transverse slices, pale orange-brown.....**Frasera.**

Aconitum

N. Aconite Root, Monkshood.—**O.** The root of *Aconitum Napellus; Ranunculaceæ.*—**H.** Mountainous parts of Europe and Asia.—**D.** Aconite root is sometimes classed as a tuber, because a small portion at the top is a root stock which produces a short lateral branch, at the end of which a new root and stem is formed; the old root ("mother tuber") has a portion of stem adhering while the younger root ("daughter tuber") is crowned with a bud, which would form the next season's stem; the two are often attached to each other in the drug, but also occur separately. The bulk of drug is root and the drug is therefore described under this group. The illustration shows the appearance of the root (A. N.) in natural size; conical or tapering, ten to twenty mm. thick at the top and three to ten cm. long, with either a bud or the remains of a stem at the apex, seldom branched, dark brown, the root with bud plump, little wrinkled, and whitish within, the one with stem remnant more deeply wrinkled and darker, even brownish within and sometimes hollow; fracture abrupt, mealy

or horny, showing five to eight-rayed star (usually seven-rayed) caused by the darker-colored cambium zone which separates the thick bark from the pith; odorless, taste at first sweetish, then acrid and followed by a tingling numbness, which is persistent and disagreeable and the intensity of which has been suggested as a good empirical test for the quality of the drug.—**C.** Aconitine, pseudaconitin, aconine, pseudaconine, picraconitine, etc., which together constitute the commercial article which is sold as

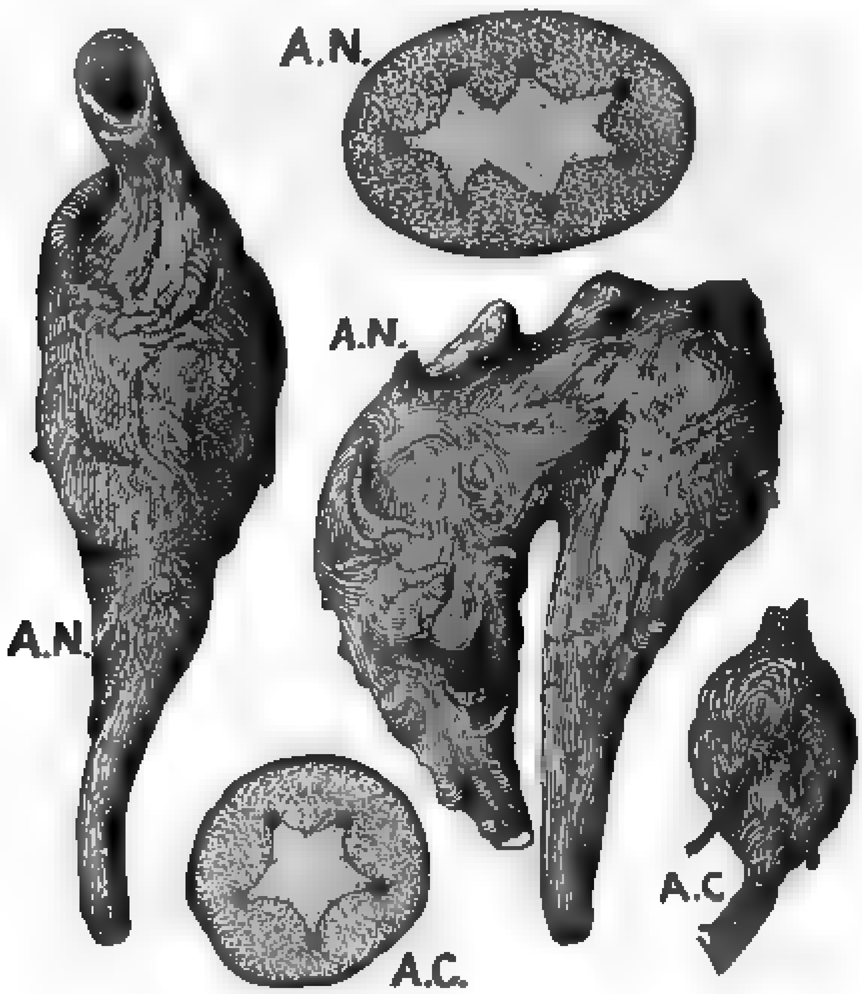


Fig. 144.

"aconitine." Pure aconitine is a crystalline alkaloid. The drug should contain not less than 0.5 per cent of ether-soluble alkaloids.—**U.** Sedative and depressant; very poisonous. Dose of aconite root: 0.05 to 0.10 gram, in tincture or fluid extract.

Antidotes.—Stomach pump or emetics (sulphate of zinc, mustard, apomorphine); friction of extremities; heart stimulants, as digitalis, atropine, or amyl nitrite inhalations; heat applied externally, etc.

Aconitum Cammarum (A.C. in Fig. 144) is also gathered in

Europe; it is only about two cm. long and sub-globular and the cambium star seldom more than five-rayed, and less marked than in *A. Napellus.*

ACONITUM STOERCKIANUM, is characterized by the "mother tuber" developing two "daughter tubers," so that it comes in triplets; the cambium zone is not stellate.

These two varieties are sometimes mixed with the roots of *A. Napellus,* and have the same action.

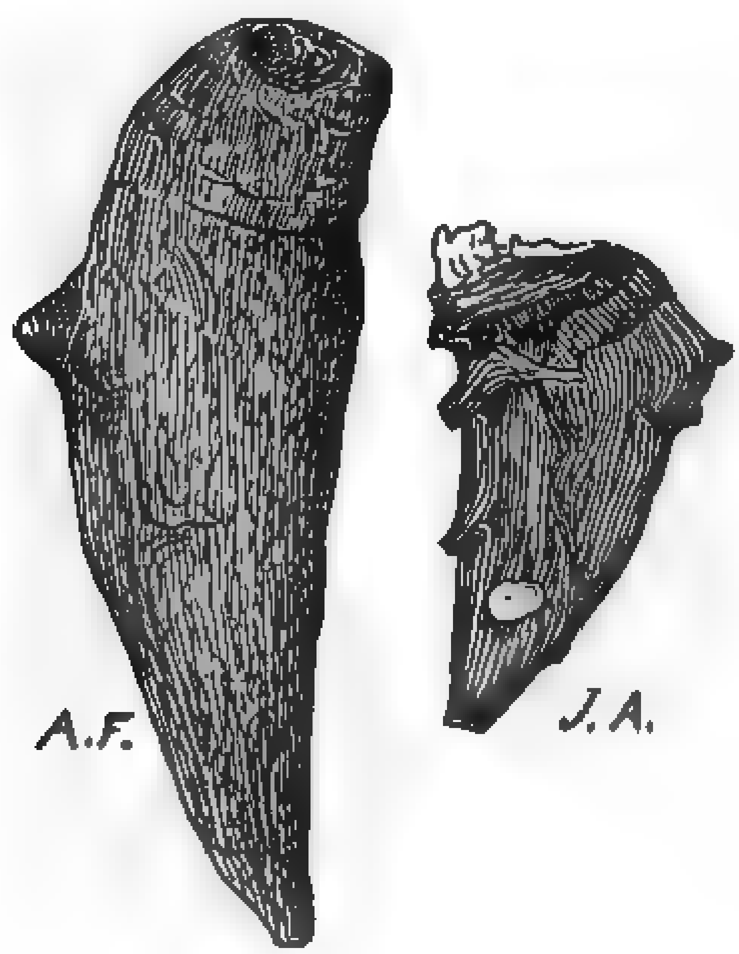


Fig. 145

INDIAN ACONITE, from *A. ferox* (A.F. in Fig. 145), called *bikh* or *bish,* is from five to ten cm. long and about twenty-five mm. thick above, conical, brown externally and reddish-brown or brownish-black internally and breaks with a resinoid fracture.

JAPANESE or CHINESE ACONITE (J.A. in Fig. 145), from *A. Fischeri,* often is napiform, tapering, with a circular or elliptical (rarely stellate) pith.

All of these roots are used for the manufacture of the commercial "aconitine."

Belladonnæ Radix

N. Belladonna Root.—**O.** The root of *Atropa Belladonna; Solanaceæ.*—**H.** Central or Southern Europe.—**D.** The illustration shows an old and thick root, with the base of the hollow stem

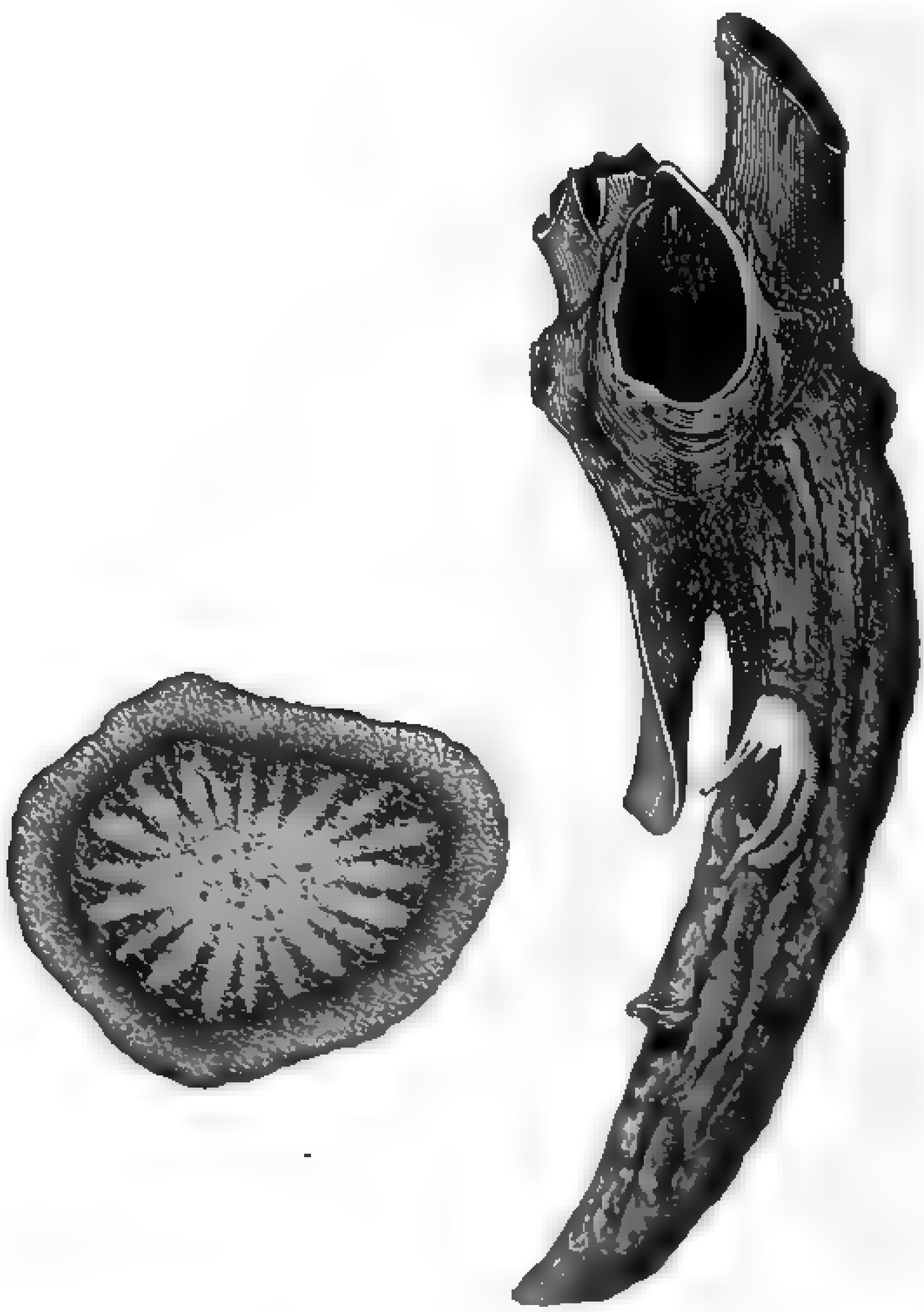


Fig. 148.

attached: the drug consists mainly of the more slender, tapering and often nearly cylindrical roots up to twenty-five cm. long and from ten to twenty-five mm. thick, externally pale brownish-gray with few and shallow longitudinal wrinkles; breaks with

an abrupt mealy fracture, the thinner pieces uniformly white within, the thicker and older pieces showing a radiating structure inside of and near the cambium zone, as shown in the drawing of a section (enlarged); odor little or none, and taste at first sweetish, then bitterish and acrid, and followed by dryness of the mouth and fauces.—**C.** Atropine and hyoscyamine; Belladonna root should contain not less than 0.5 per cent of mydriatic alkaloids.—**U.** Anodyne, narcotic; dilates the pupils of the eyes; suppresses the secretions of the salivary and sweat glands; in medicinal doses it is a valuable stimulant of the respiratory muscles and the heart, but in overdoses it is a narcotic poison and paralyzes the heart; externally, as an ingredient of plasters, it is a valuable anodyne and anti-neuralgic and the ointment of belladonna is applied to the breasts to suppress the secretion of milk. Dose: About 0.05 gram.

"Roots which are tough and woody, breaking with a splintery fracture, should be rejected; likewise the hollow stem-bases which are sometimes present" (U.S.P.); but this empirical rule will sometimes lead to the rejection of a good drug, because a drug as here described occasionally assays as high as the drug described above, and which usually is the better; no large lot of roots should be rejected on its appearance alone; but a quantitative assay should be made to determine the quality of the drug.

(See also **Scopola**, page 251.)

ANTIDOTES.—The poisonous effect shows itself by extreme dilatation of the pupils, dryness of the fauces, headache, delirium, stupor, paralysis, weak pulse and respiration, and finally death. Treatment consists in the use of the stomach pump or emetics, opium internally and stimulants when heart failure is threatened.

Rheum

N. Rhubarb.—**O.** The root of *Rheum officinale, Baillon, Rh. palmatum,* and allied varieties of *Rheum; Polygonaceæ.*—**H.** Western and Central China.—**D.** Cylindrical, conical or irregular, or flattish, often plano-convex pieces of root, deprived of the corky layer and often of the middle bark, covered externally with an orange-yellow powder (from attrition) which when rubbed off shows meshes of white, spongy tissue and short, reddish-brown or brownish-yellow striæ; compact and hard, breaking with an

uneven fracture, the broken surface being whitish and marbled or mottled with yellowish-red striæ which are sometimes arranged in star-shaped spots or clusters; the parenchymatous cells are filled with starch or stellate, rosette-shaped crystals of oxalate of calcium which feel gritty between the teeth, and the cells of the medullary rays are filled with a reddish coloring matter which colors the saliva yellow; the odor is peculiar and the taste is bitter, disagreeable and slightly astringent.—**C.** Two groups of glucosides, tanno-glucosides and anthra-glucosides, chrysophanic acid, emodin, tannin, etc.—**U.** Rhubarb is at first purgative, followed afterwards by an astringent action; it is therefore especially adapted for use in cases of diarrhœas caused by irritating substances in the intestines, such as indigestible food, etc. Dose: 0.3 to 1.5 grams.

The rhubarb described above is called CHINESE, SHENSI or EAST INDIAN RHUBARB.

RUSSIAN RHUBARB is no longer found in the trade and is only of historical interest. It therefore needs no description here.

RHAPONTIC RHUBARB, also called CRIMEAN RHUBARB, is the root of *Rheum rhaponticum*, which is a native of Western Asia, but is now also cultivated in Europe and in the United States, being known here as "pie plant." When the root is found in the trade it is usually in slender cylindrical pieces of an orange-red color, about ten to twelve cm. long and two cm. thick, resembling the official rhubarb in color, odor and taste, but being more astringent and mucilaginous, and less gritty.

EUROPEAN RHUBARB, from *Rheum palmatum, R. rhaponticum, R. compactum, R. undulatum, R. Emodi* and other species of *Rheum*, is sometimes trimmed to resemble Chinese rhubarb, but the taste is more mucilaginous and less gritty. Seldom used. The leaf-stalks are used in Europe as we use them here, for cooking.

Senega

N. Senega, Senega Snake-root.—**O.** The root of *Polygala Senega; Polygalaceæ.*—**H.** Southern United States.—**D.** A fleshy, tapering, somewhat tortuous and slightly branched root, with a many-headed caudex often having the remains of numerous stems attached, of the size shown in the illustration, or frequently much smaller; deeply wrinkled and with a "keel" or prominent ridge

in the concave parts of the bends of the roots, which constitutes a diagnostic feature; externally yellowish-gray to yellowish-brown, internally pale yellowish-white; bark thick and wood-cylinder incomplete and irregularly excentric as shown in the drawings of sections which were enlarged from actual specimens; odor slight but disagreeable and taste at first insipidly sweetish, afterwards acrid.—**C.** Senegin (Saponin) and polygalic acid, etc.—**U.** Stimulant and alterative blennorrhetic and expectorant, acting especially on the bronchial mucous membranes. Dose: 0.5 to 1.5 grams.

The above describes SOUTHERN SENEGA. NORTHERN SENECA,

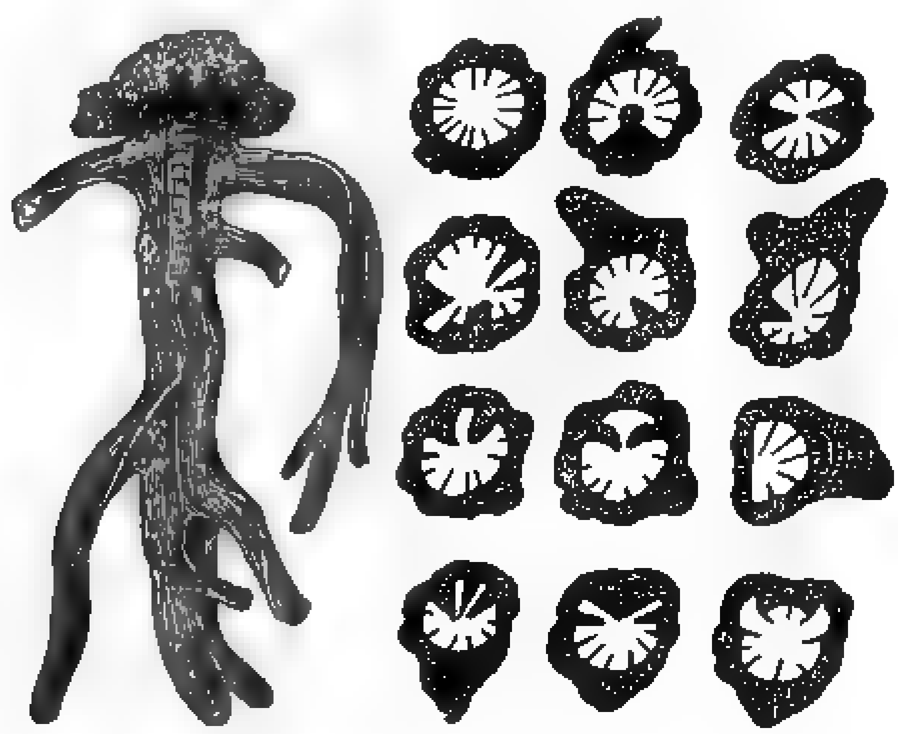


Fig. 147.

from *Polygala alba,* is inferior; it is thicker, lighter-colored, without keel, with the woody portion thick and regular. Other (so-called "spurious") senegas are excluded by the official description.

Gentiana

N. Gentian.—**O.** The root of *Gentiana lutea; Gentianaceæ.*—**H.** The mountainous regions of Central and Southern Europe.—**D.** A fleshy root, sometimes with a several-headed caudex, cylindrical, little branched, of various lengths up to 20 cm. long, about 25 millimeters thick, annulate at the upper end, deeply wrinkled

longitudinally, occasionally split lengthwise, dark brown externally and cinnamon-colored internally, breaking with abrupt brittle fracture in dry weather but somewhat flexible in damp weather, with a rather thick bark and a soft fleshy wood, without pith, and free from starch; odor faint and taste intensely and persistently bitter.—**C.** The amorphous glucoside *gentiopicrin*, gentisic acid, gentianose, pectin, etc.—**U.** A bitter tonic. Dose: 0.5 to 2 grams.

Sometimes the roots of *G. purpurea, G. punctata* and *G. pannonica* are also gathered and mixed with the official drug. These roots

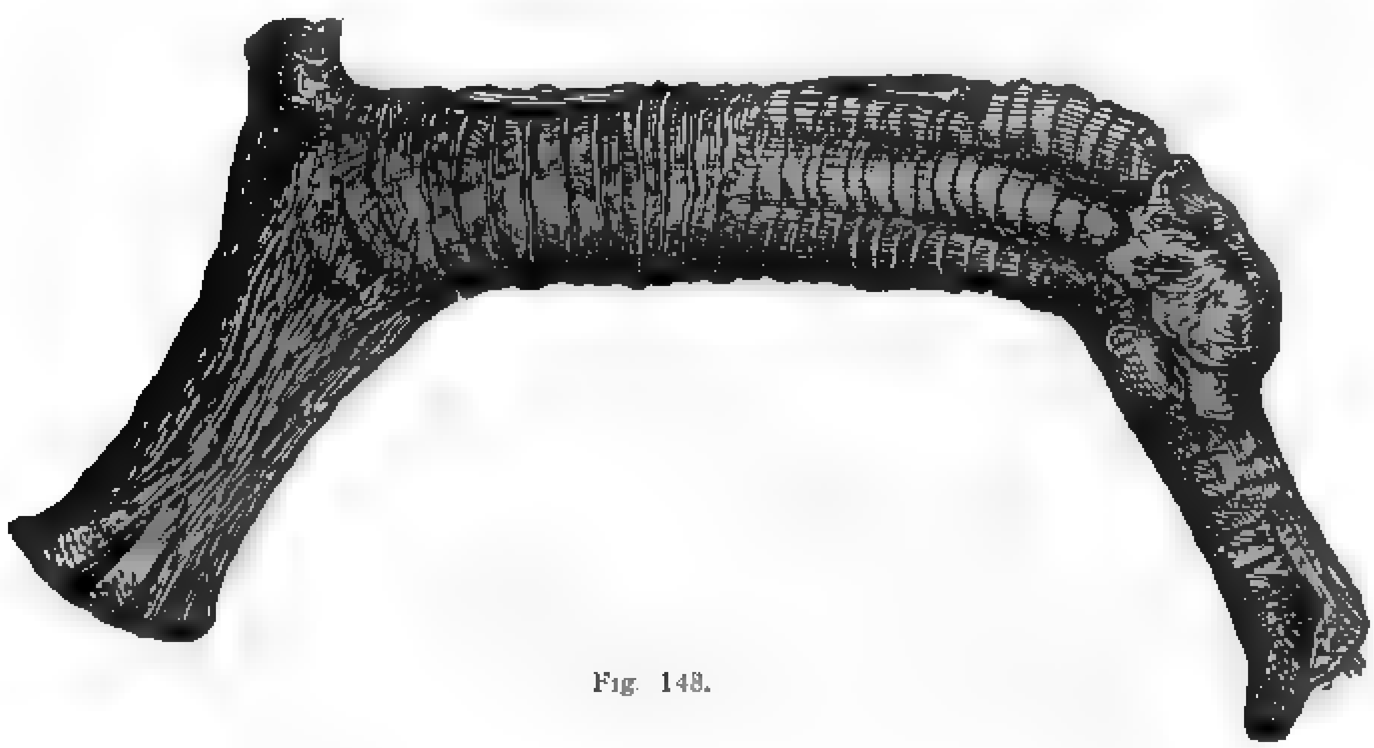


Fig. 148.

are similar in action and in appearance to that of *G. lutea* and this admixture is not considered to be objectionable.

Calumba

N. Calumba, Colombo.—**O.** The root of *Jateorhiza palmata; Menispermaceæ.*—**H.** Eastern Africa, especially Mozambique, where the plant grows wild; it is also cultivated in some of the East Indian Islands.—**D.** The fresh large fleshy root is cut into tranverse sections which are circular or broadly elliptical, from three to six cm. in diameter and from eight to twelve mm. thick, often depressed around the center which latter may however project as a nipple-like elevation; the exterior surface is brownish-green, while the cut surfaces are yellowish-gray with a brighter

yellow color in the bark under the epidermis, and with the cambium zone often distinctly marked by a brownish-gray line which is crossed by numerous more or less distinctly marked radiating lines; breaks with an abrupt brittle and mealy fracture; odor slight and taste mucilaginous and bitter. Sometimes longer cylindrical or tapering pieces are found which are the branches or ends of the roots without being cut into transverse slices, but they are readily recognized as calumba by the resemblance to the sections.—**C.** Columbin, berberine, etc.—**U.** Bitter tonic. Dose: 0.5 to 2 grams.

Calumba must have a good bright color. Worm-eaten and dark or dirty-colored calumba is more common than the sound drug,

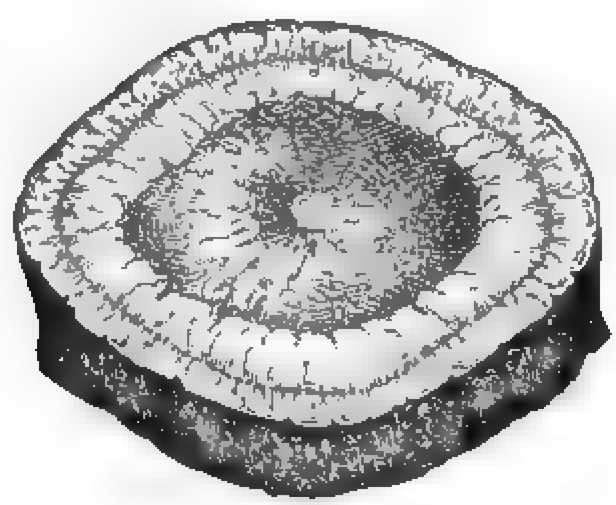


Fig. 149.

and such inferior drug should be rejected. This drug is said to be occasionally adulterated with transverse slices of other roots, such as bryonia, etc., but it is doubtful whether such additions are practicable as they are too easily recognized by even a novice.

Bryonia

N. Bryonia, Bryony.—**O.** The roots of *Bryonia alba* and of *Bryonia dioica; Cucurbitaceæ.*—**H.** Central and Southern Europe.—**D.** Transverse sections, 3 to 6 cm. diameter, about 6 mm. thick, grayish-brown externally and the grayish-white cut surfaces marked with rough concentric and radiating lines due to projecting fibrovascular bundles; hard, breaking with abrupt, brittle and mealy

fracture; no odor but taste bitter and nauseous.—**C.** A bitter glucoside, bryonin, etc.—**U.** Hydragogue cathartic. Dose: 0.5 to 4 grams.

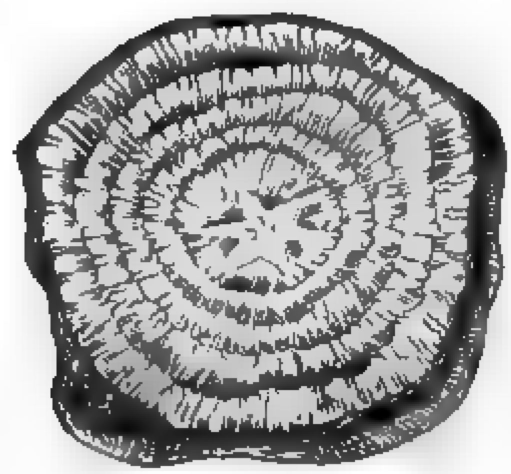


Fig. 150.

The drug obtained from *B. dioica* is smoother and more mealy on its cut surfaces than that derived from *B. alba*.

Althæa

N. Marshmallow Root.—**O.** The root of *Althæa officinalis; Malvaceæ*. From plants at least two years old.—**H.** Europe, Western and Northern Asia; cultivated in Europe; naturalized in United States.—**D.** Irregularly cylindrical or tapering pieces, 10 to 20 cm. long and about 10 to 20 mm. thick; deprived of the ex-

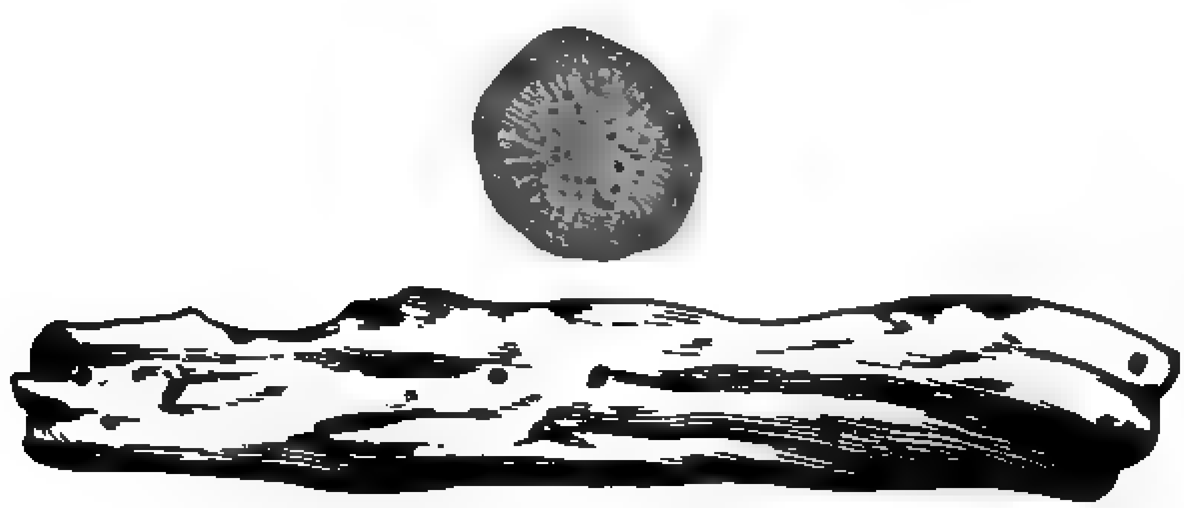


Fig. 151.

ternal bark; without rootlets, but with numerous round spots or root-scars; deeply wrinkled longitudinally; externally and internally white, mealy and fibrous; fracture abrupt and mealy; odor

faintly aromatic and taste sweetish mucilaginous.—**C.** Asparagin, pectin, mucilage (35 per cent) and starch (35 per cent).—**U.** Demulcent. Dose: Ad libitum.

As usually bought and sold by the retail pharmacist it is cut into small cubes (about 3 or 4 mm. on each side) which are white, and readily recognized by the peculiar odor of the drug. A discolored or mouldy root, or one having a disagreeable or sourish odor or taste, must be rejected.

Phytolaccæ Radix

N. Poke Root.—**O.** The root of *Phytolacca decandra; Phytolaccaceæ.*—**H.** Indigenous; naturalized in S. Europe and West Indies.

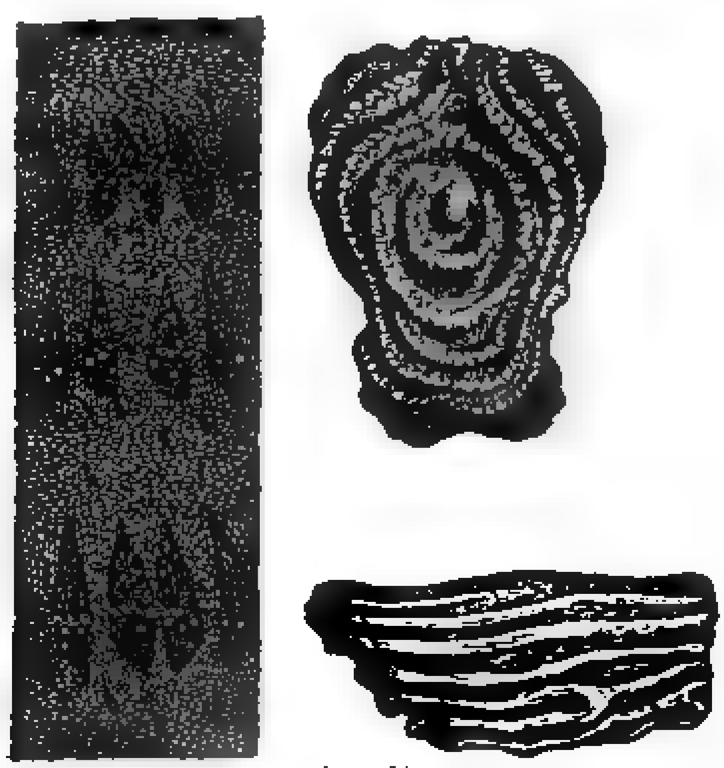


Fig. 152.

dies.—**D.** The root is a large fleshy, conical root, grayish-brown externally, whitish within, sometimes as much as twenty cm. thick at the upper end and up to one-half meter long, with many heads to which remnants of hollow stems containing transverse shreds of pith are attached.

A transverse section shows the fibro-vascular bundles to be arranged in irregularly concentric circles, as shown in the drawing of a microscopical section of a small piece (to the left, in Fig. 152); this arrangement of the bundles explains the appearance of the drug as found in the trade, for when dry the parenchyma

shrinks more than the bundles and becomes light brownish-gray while the bundles remain whitish, and project above the shrunken parenchyma. In the trade the root is found in transverse or longitudinal slices to some of which portions of the hollow stems remain attached; one of these drawings is of a small transverse slice as it appeared in the evening with the light falling on it obliquely, thus illuminating the projecting lines of fibro-vascular bundles, deepening the tints of the parenchyma by the strong shadows, thus exaggerating the contrast in color but showing the relief more clearly; the lower right-hand figure illustrates a small fragment of a longitudinal slice; the drug is hard and breaks with a fibrous fracture; odor, none; taste sweetish acrid.—**C.** No active principle has been isolated but the action probably depends on an undetermined glucoside.—**U.** Has been highly recommended as an alterative antiarthritic in rheumatism, and as a solvent in inflammation and threatened abscess of the breast. Dose: 0.05 to 0.5 gram; in overdoses it is poisonous.

Rumex

N. Yellow Dock, Radix Lapathi.—**O.** The root of *Rumex crispus*

Fig. 153.

and of other varieties of *Rumex; Polygonaceæ.*—**H.** Europe; naturalized in North America.—**D.** A long, tapering, simple fleshy root with but few root-fibers, sometimes somewhat fusiform, annulate above, deeply wrinkled below; generally broken as in the drawing which is about five-sixths natural size, the tough fibrous wood

bundles, especially in the larger and older roots, holding the broken parts together; ten to thirty cm. long and twelve to fifteen mm. thick; externally brown or reddish-brown, internally somewhat horny and dingy brownish-yellow; stains the saliva yellow; little or no odor and a bitter astringent taste.—**C.** Tannin, chrysophanic acid, etc.—**U.** Alterative, astringent, tonic. Dose: 2 to 5 grams.

Symphytum

N. Symphytum, Comfrey.—**O.** The root of *Symphytum officinale; Boraginaceæ.*—**H.** Europe and United States.—**D.** The nearly simple root is up to fifteen cm. long and from eight to twenty mm.

Fig. 154.

thick, the larger pieces often split lengthwise, very hard, wrinkled, somewhat twisted, blackish-brown externally and whitish within; breaks with an abrupt, somewhat brittle fracture, the broken end appearing whitish and horny; odorless, and taste sweetish, mucilaginous and slightly astringent.—**C.** Mucilage, asparagin, tannic acid, etc.—**D.** Demulcent and slightly astringent. Dose: 5 to 15 grams per day.

Saponaria

N. Saponaria, Soapwort.—**O.** The root of *Saponaria officinalis; Caryophyllaceæ.*—**H.** Europe and America. **D.** Cylindrical, about twenty-five cm. long but usually broken into shorter lengths, the older roots up to twelve mm. or more in thickness; formerly the

roots from older plants were more common than at present, and these were marked with distinct annual layers, but now the thin roots from one-year-old plants are preferred and these appear as in the drawings, from two or three to twelve mm. thick, rusty or

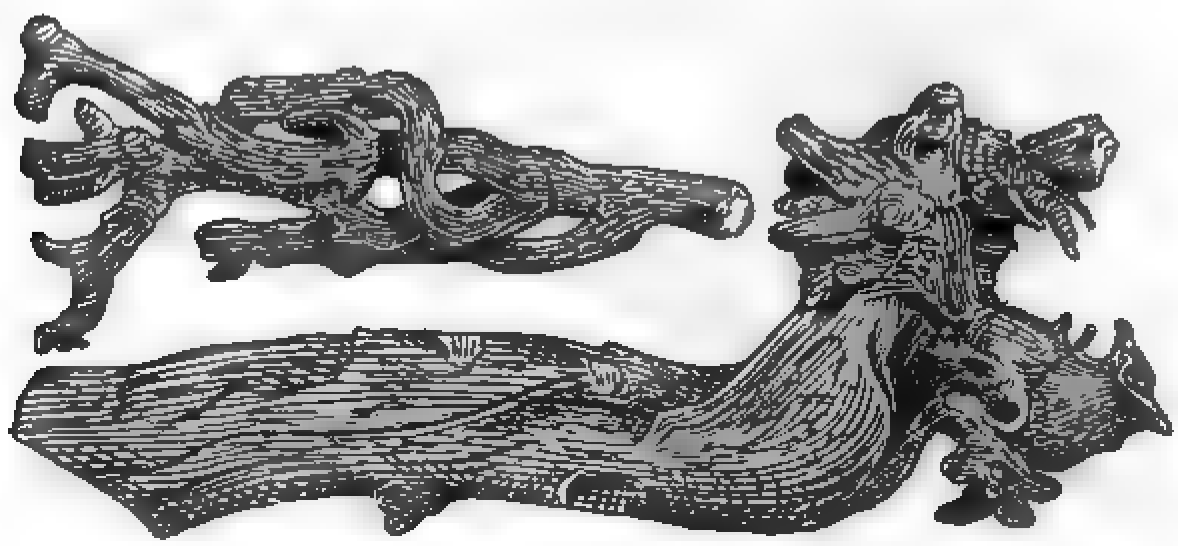


Fig. 155.

reddish-brown externally, hard, with abrupt fracture, the section showing a thick whitish bark and a delicate brownish cambium zone surrounding a pale yellowish wood without radiating markings; no odor and a somewhat bitter and afterwards acrid taste. The smaller roots are to be preferred and large and woody roots should be rejected.—**C.** Saponin, etc.—**U.** Alterative diaphoretic; used similarly to Sarsaparilla in chronic skin diseases, etc. Dose: 25 to 50 grams during the day, in infusion.

Lappa

N. Burdock. Radix Bardanæ.—**O.** The root of *Arctium Lappa* and of some other species of *Arctium; Compositæ.* From one-year-old plants.—**H.** Europe and Northern Asia; naturalized in North America.—**D.** A simple, fleshy, fusiform root about thirty cm. long to three cm. thick; crowned with a tuft of whitish, soft, hairy leaf-stalks; externally grayish-brown and internally paler brown; fracture somewhat horny; bark thick and with occasional spaces containing a whitish felt-like mass of broken-down tissue, the cambium zone dark-colored, wood radiate and the center having spurious pith or cavities filled with a similar white tissue-debris as is found in the spaces in the bark; odor faint but disagreeable, and taste sweetish-

bitter and mucilaginous. The root usually comes into trade split lengthwise, so that the glistening white spurious pith becomes a characteristic and diagnostic feature.—**C.** Inulin (no starch), mucilage, bitter extractive, etc.—**U.** Diaphoretic, diuretic and alterative.

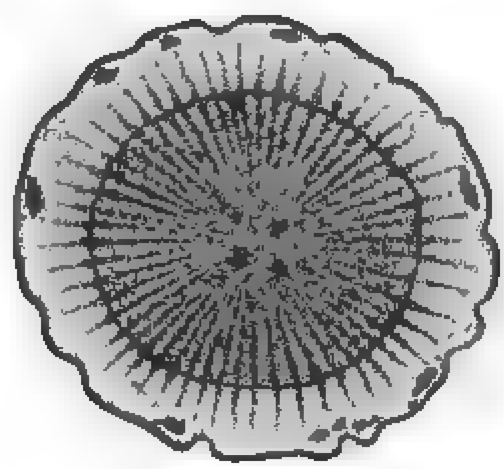


Fig. 156.

Has been very highly praised as a remedy in psoriasis and other skin diseases. Dose: 1 to 5 grams.

Alkanna

N. Alkanet.—**O.** The root of *Alkanna tinctoria; Boraginaceæ.*—**H.** Southeast Europe and Western Asia.—**D.** A long, fleshy, cylindrical, slightly branched root with a several or many-headed caudex to which tufts of leaf-bases remain attached, usually broken in pieces about ten cm. long and finger-thick, most of the thickness consisting in the dry drug of a thick bark, the outer layers of which are foliaceous or torn into many shreds, which are but loosely adherent to each other and to the inner bark and wood, which latter is also often torn into its separate bundles during drying; the bark and medullary rays are dark purplish-violet in color, while the wood-bundles are yellowish, all parts being readily friable; little or no taste or odor.—**C.** Alkannin, a deep red coloring matter which is soluble in alcohol, oils, fats, etc., but insoluble in water.—**U.** For coloring hair-oils, pomades and other fatty preparations.

As the coloring matter is mainly found in the bark, the value of the drug depends on the proportion of bark present, and as this is sometimes sold separately, a drug consisting to any undue extent of the wood bundles should be rejected.

Frasera

N. Frasera, American Colombo, American Gentian.—**O.** The root of *Frasera Walteri; Gentianaceæ.*—**H.** United States, Alleghenies and westward.—**D.** A large fleshy root which formerly was sometimes cut into transverse slices resembling Calumba (whence the name American Colombo), but is now usually split in longitudinal slices, as shown in the illustration (Fig. 157) in natural size, annulate above, wrinkled longitudinally below, brown externally, light yellowish-brown within, odor reminding

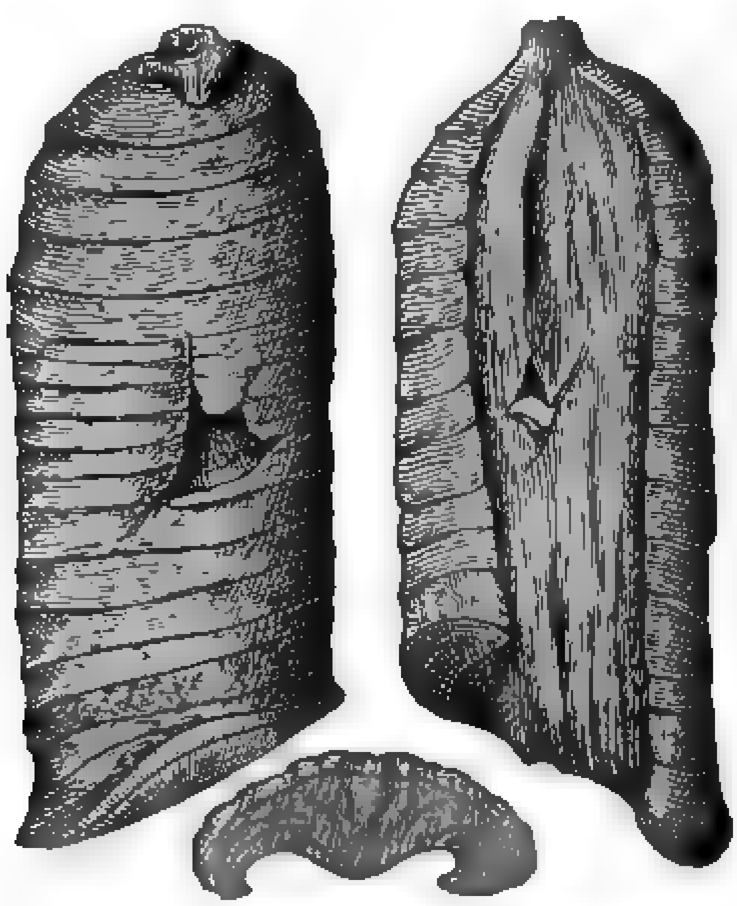


Fig. 157.

of gentian, taste sweetish and afterwards bitter.—**C.** Similar to those of gentian, *gentiopicrin,* etc.—**U.** Bitter tonic. Dose: 1 to 5 grams.

RHIZOMES

The stems of many plants are too weak to stand upright, and such stems lie procumbent on the ground, branching diffusely in a horizontal direction; such stems may lie on top of the ground, or be partially covered by the ground, or they may grow just

below the surface of the ground, usually producing rootlets at the nodes in contact with the soil. Such stems are called "creepers;" or when they are habitually covered altogether by the ground, they are called "rhizomes."

Rhizomes are underground stems, distinguished from roots by having nodes and internodes which are absent in roots; they may vary in length, some being creeping and often quite long, others being short and compact; some come into trade with the roots (usually simple "rootlets") attached, some without the roots; these rootlets are in some attached all around and along the full length, in some only on the under side, and in others only at the nodes, and when they are broken off the resulting scars are often characteristic and aid in the recognition of the drug. The remains of leaves or stems are often attached to the growing ends of rhizomes. We group the commercial drugs of this class, first, according to their most striking peculiarity, the presence or absence of rootlets, then according to structure (acrogenous, endogénous, exogenous, or with or without ducts, as the case may be) and to some extent according to shape (long or short).

Rhizomes are generally spoken of in the trade as "roots," but while there may be no serious objection to the continuance of this practice, yet the difference between roots and rhizomes must of course be always remembered by the student of pharmacognosy, as otherwise the confusion of terms may seriously interfere with the ready recognition of the respective drugs.

When grouping according to presence or absence of rootlets we must remember that when drugs are gathered by savage or barbarous people, these people do things in a routine manner and do not deviate from the methods of their ancestors, and such drugs are gathered, cut, dried and put up for the trade as they have been for generations or perhaps for centuries; thus calumba always was and still is cut into transverse slices. On the other hand, civilized people vary the methods of trimming, often in an arbitrary or capricious manner, as when veratrum viride is sometimes whole with rootlets, sometimes without rootlets, or sometimes cut longitudinally into halves or quarters or sliced transversely into sections. So it happens that while a drug may be classed as a rhizome with rootlets, it may occasion-

ally be found without rootlets, or vice versa; yet in most cases the drugs are as is herewith explained and deviations are exceptional.

- RHIZOMES
  - With rootlets
    - Mono-cotyledonous 22
    - Di-cotyledonous
      - With ducts* 23
      - Without ducts* 24
  - Without rootlets
    - Cryptogamous 25
    - Mono-cotyledonous
      - long 26
      - short 27
    - Di-cotyledonous
      - long 28
      - short 29

GROUP XXII

Mono-cotyledonous Rhizomes With Rootlets

Endogenous or mono-cotyledonous rhizomes, whether with or without rootlets, are readily recognized by the manner of distribution of fibro-vascular bundles, as well as by the nucleus sheath when the latter is present, as has already been described.

Grayish or brownish, deeply-wrinkled roots, often over one meter long, folded back over a compact rhizome...... **Sarsaparilla.**

Obconical, blackish-gray with shriveled, lighter-colored rootlets .... **Veratrum Viride.**

Thin, branched, straw-colored or pale yellowish, with hair-like rootlets at nodes................................ **Convallaria.**

Jointed, deeply-wrinkled, flattish, grayish-brown, annulated with darker colored markings........................ **Iris Versicolor.**

Obconical to sub-globular, annulate, orange-brown........ **Trillium.**

Obconical, grayish-brown, with rootlets on upper part; whitish within .... **Dracontium.**

Bent, orange-brown, with many stem-scars above and wavy rootlets below .... **Cypripedium.**

Whole, or longitudinal slices, yellowish-brown, whitish within, annulate .... **Polygonatum.**

Much branched and curved; pale brown, very hard and tough .... **Dioscorea.**

Sub-cylindrical, curved, grayish-brown with tough, wiry rootlets .... **Helonias.**

Cylindrical, covered with tufts of leaf-bases and numerous pale-colored and soft rootlets........................ **Aletris.**

Flattish-cylindrical, reddish-brown, with root-scars in wavy lines on under side.................................. **Calamus.**

*Oil, resin or latex ducts, spaces or large cells.

Sarsaparilla

The various kinds of Sarsaparilla have been fully described in Group XVI, where they properly belong, as the roots alone are directed to be used, and where descriptions will be found. MEXICAN and JAMAICA SARSAPARILLAS usually consist of the rootlets attached to the "chumps" or rhizomes, and therefore might naturally be looked for here, wherefore they must be mentioned.

Veratrum Viride

N. Veratrum, American Hellebore.—**O.** The rhizome and rootlets of *Veratrum viride; Liliaceæ.*—**H.** North America.—**D.** Up-

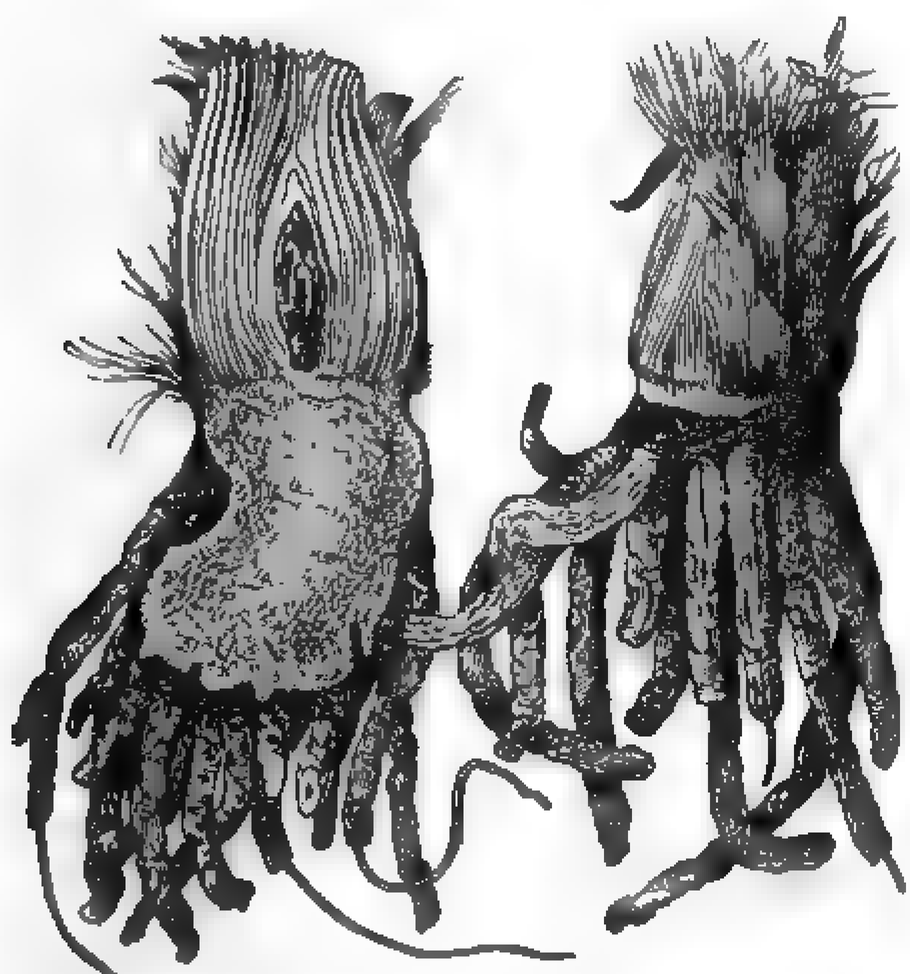


Fig. 158.

right obconical rhizome, from three to eight cm. long and two to three cm. thick, when dried, often crowned with concentric layers of leaf-bases, externally blackish-gray and covered with light-brown deeply-wrinkled rootlets up to ten or more cm. long and two mm. thick, from which the bark can be readily torn, showing an almost white fibrous wood; sometimes the rhizome is cut

into halves longitudinally, as shown in one of the figures, or it may occasionally occur in transverse sections, or even without rootlets, although this is more rarely the case; it is without odor but is a powerful sternutatory when the powder is inhaled; the taste is bitter and acrid.—**C.** Jervine, veratroidine, etc.—**U.** Sedative and antispasmodic, especially in puerperal convulsions; emetic, diaphoretic, and errhine. Dose: 0.1 to 0.3 gram, best given as fluid extract or tincture.

While generally considered a dangerous or even poisonous remedy, it is claimed that no fatal effects have ever been observed from an overdose. Antidotal treatment should consist of emesis (usually effected by the drug itself), stimulants, alcoholics or ammonia, warm applications, etc.

VERATRUM ALBUM, or White Veratrum, is a European variety of this drug, which is similar to the American drug in appearance as well as in action, and is used for the same purposes.

Convallaria

N. Convallaria, Lily of the Valley Root.—**O.** The rhizome and rootlets of *Convallaria majalis; Liliaceæ.*—**H.** Northern temperate zone; cultivated in gardens.—**D.** The drug consists of a tangled or matted mass of pale straw-colored or yellowish, but not glossy, rhizomes and rootlets; the rhizomes sometimes branched, but usually simple, often with the growing end thickened and annular and crowned with a mass of soft, whitish, threadlike hairs (the remnants of leaf bases); this thicker end contracts either abruptly or tapers to a thin rhizome, which is lighter-colored than

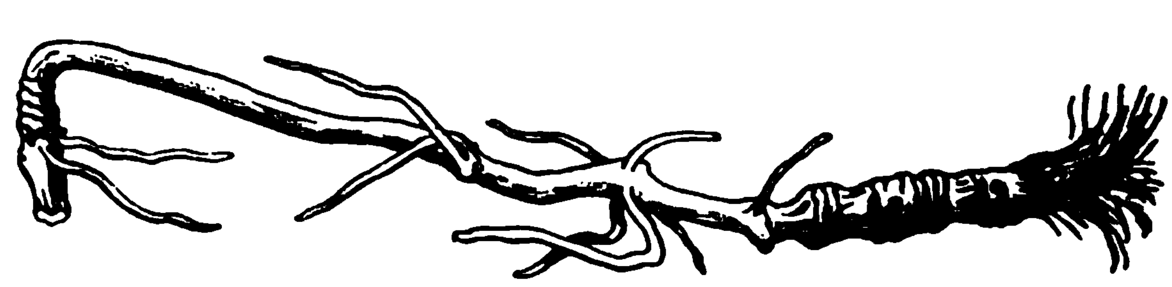


Fig. 159.

the thick end and slightly wrinkled longitudinally; from five to ten cm. long and two to three mm. thick, with internodes from two to five cm. long, and with a few thin, almost threadlike rootlets attached at the slightly thickened nodes or joints; the fracture is tough and fibrous and the interior is white; the drug has no odor, and the taste is bitter and slightly acrid.—**C.** Conval-

larin, convallamarin, etc.—**U.** Heart tonic, especially useful in cardiac dropsies; in overdoses poisonous. Dose: 0.5 to 2 grams daily.

Iris Versicolor

N. Blue Flag.—**O.** The rhizome of *Iris versicolor; Iridaceæ.*—**H.** In swampy localities in North America.—**D.** In pieces of various lengths, sometimes branched, but usually simple; internodes five to ten cm. long, cylindrical at the older end and flattish at the growing end, where the numerous long, simple rootlets are attached when present; the upper (growing) end is marked with a circular stem-scar, the nodes with small circular root-scars when the roots are absent, and the whole length is marked by alternate lighter and darker-colored annular markings due to the leaf-scars, as shown in the illustration which shows a piece

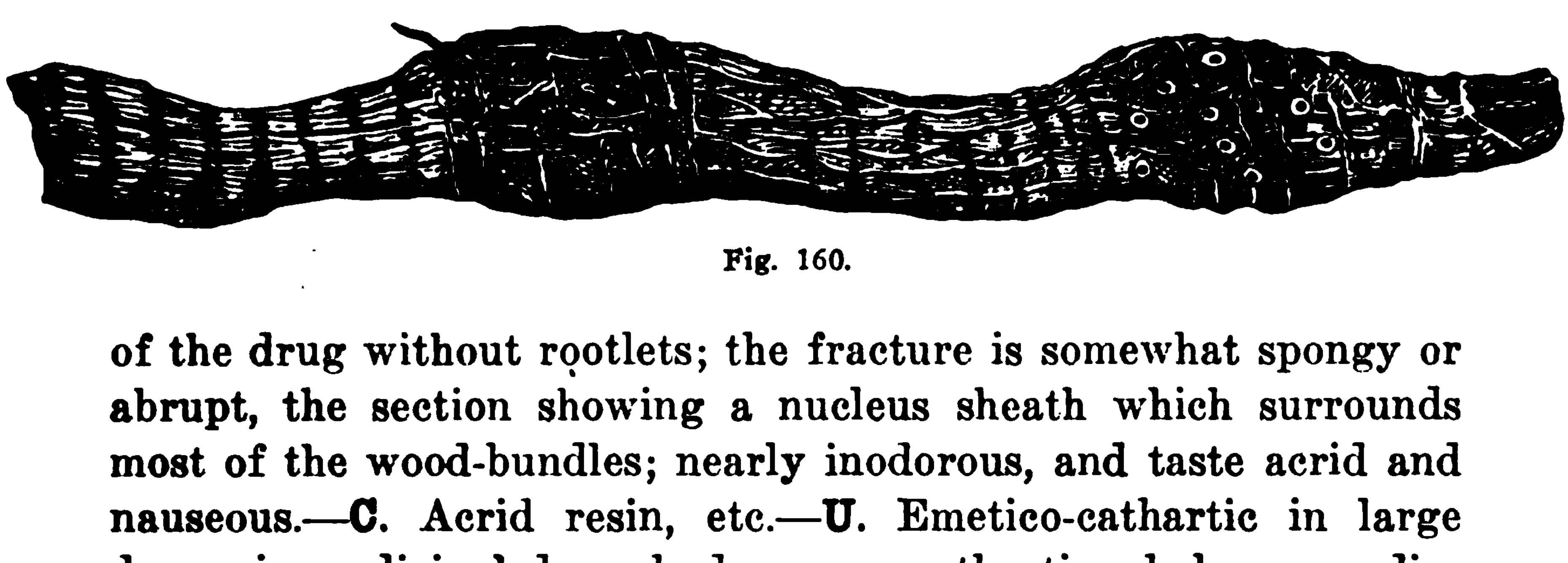


Fig. 160.

of the drug without rootlets; the fracture is somewhat spongy or abrupt, the section showing a nucleus sheath which surrounds most of the wood-bundles; nearly inodorous, and taste acrid and nauseous.—**C.** Acrid resin, etc.—**U.** Emetico-cathartic in large doses; in medicinal doses hydragogue cathartic, cholagogue, diuretic and alterative. Dose: 0.5 to 1 gram. This drug is often found in the trade without rootlets, and it is therefore also mentioned under Group XXVI. A lot of well-cleaned rootless blueflag looks more attractive, although there is probably no preference from a therapeutical standpoint.

Trillium

N. Beth-root, Birth-root.—**O.** The rhizome of *Trillium erectum* and other varieties of *Trillium; Liliaceæ.*—**H.** United States.—**D.** Obconical to subglobular, often somewhat flattened, from two to five cm. long, shaped as shown in the drawing; annulate, with the few and short rootlets attached near the upper end, which is

sometimes tufted with leaf-remnants; externally light yellowish-brown, internally whitish, inodorous and taste somewhat astringent, afterwards bitter and acrid.—**C.** Acrid glucoside, etc.—**U.**

Fig. 161.

Used in genito-urinary troubles, as menorrhagia, leucorrhœa, etc.; emmenagogue and emetic. Dose: 2 to 5 grams.

Dracontium

N. Skunk Cabbage.—**O.** The rhizome of *Dracontium fœtidum (Symplocarpus fœtidus); Araceæ.*—**H.** North America.—**D.** From five to ten cm. long and half as wide, obconical, shaped as shown in the drawing; the upper end usually has concentrically arranged leaf-remnants and numerous long, shriveled and deeply

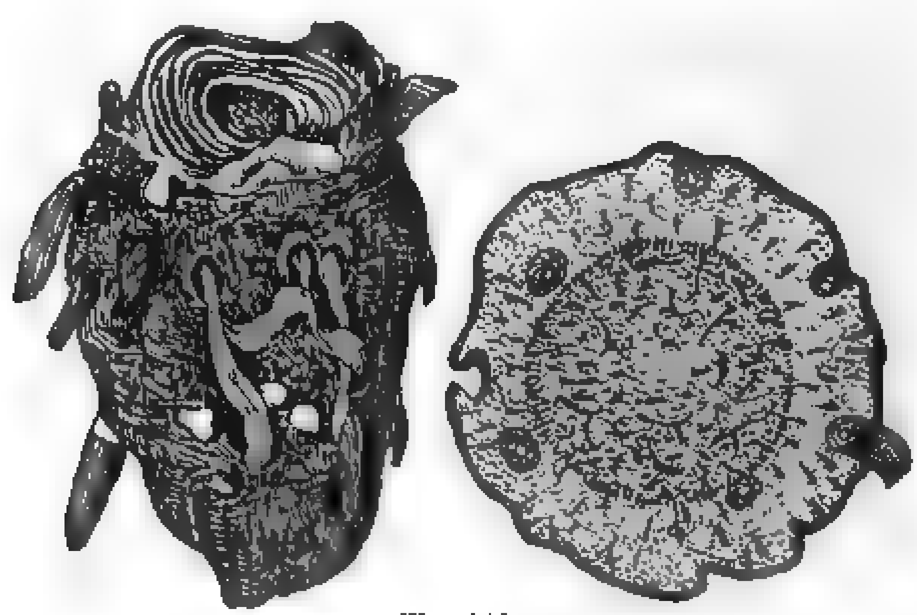


Fig. 162.

wrinkled rootlets attached, but these roots are often cut from the rhizomes and either come loose and separate in the bales or are absent; the drug is dark grayish-brown externally and whit-

ish within, but when it comes cut into slices or into longitudinal quarters, which is frequently the case, the cut surfaces on drying also appear grayish; the odor reminds one of a polecat, whence the name of the drug, and the taste is pungent and acrid.—**C.** Resin, an acrid volatile principle (the latter not isolated), etc.—**U.** Stimulant and anti-spasmodic; used in hysteria, etc. Dose: 0.5 to 2 grams.

Cypripedium

N. American Valerian, Lady's Slipper; commonly, but erroneously, called Ladies' Slipper.—**O.** Rhizome and roots of *Cypripedium pubescens* and *C. parviflorum; Orchidaceæ.*—**H.** United States.—**D.** The rhizome is usually curved or bent, beset with numerous long wavy rootlets which become entangled so that

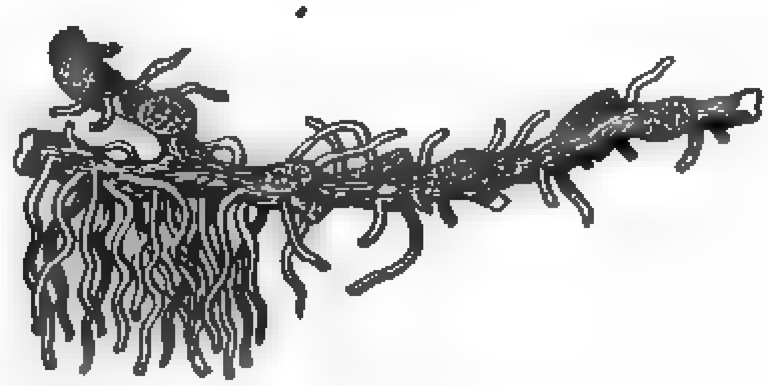


Fig. 163.

the drug is a matted mass; in the illustration most of the rootlets are represented as removed, to show the nature of the rhizome, which is marked on its upper side with numerous circular cup-shaped but very shallow stem-scars, which are about as far apart from the edge of one to the edge of the other, as the diameter of such a scar; the rhizome is from five to ten cm. long and about three mm. thick, and the rootlets are up to twenty cm. long and about 1.5 mm. thick; dark brown to light orange-brown; fracture brittle, showing yellowish-white within; a faint but sickening odor and a sweetish-bitter and slightly pungent taste.—**C.** No active principle has been isolated; fixed oils, resins, etc.—**U.** Diaphoretic, anti-spasmodic and nervine. Dose: 0.5 to 2 grams.

According to Maisch the rhizome of *C. pubescens* is the longer of the two rhizomes and is usually bent with a shallow curve, depressed in the middle so as to make a U-shaped curve; this may be

remembered by thinking of the first letters which differ in the names of the two drugs, *Cypripedium pubescens* having a **u** where *Cypripedium parviflorum* has an **a**. The rhizome of the latter plant is contorted, often bent at right angles, or with an upward curve. In both the rootlets spring from all sides of the rhizomes but bend abruptly downward, hiding the rhizome, so that to examine the latter the rootlets must be removed as was done prior to making the illustration.

Polygonatum

N. Solomon's Seal.—**O.** The rhizomes of several varieties of *Polygonatum, Polygonatum giganteum, P. biflorum, P. multiflorum,* and *P. uniflorum; Convallaria Polygonatum; Liliaceæ.*—**H.** The first two are indigenous, the third grows in Europe and America, and *P. uniflorum* is a European plant.—**D.** The drug varies in size as it comes from one or another of these plants, but is always a rhizome with nodes, on the upper side of which are depressed stem-scars which resemble the impressions of a seal, wherefore the drug is called "Solomon's Seal." A common form of the drug is as in the drawing, the upper figure of which shows the shape of the fresh rhizome reduced, but which is in reality about fifteen cm. long and up to four or five cm. broad, but in the drug is usually sliced longitudinally as shown in the lower figures; each joint is marked with a stem-scar; the

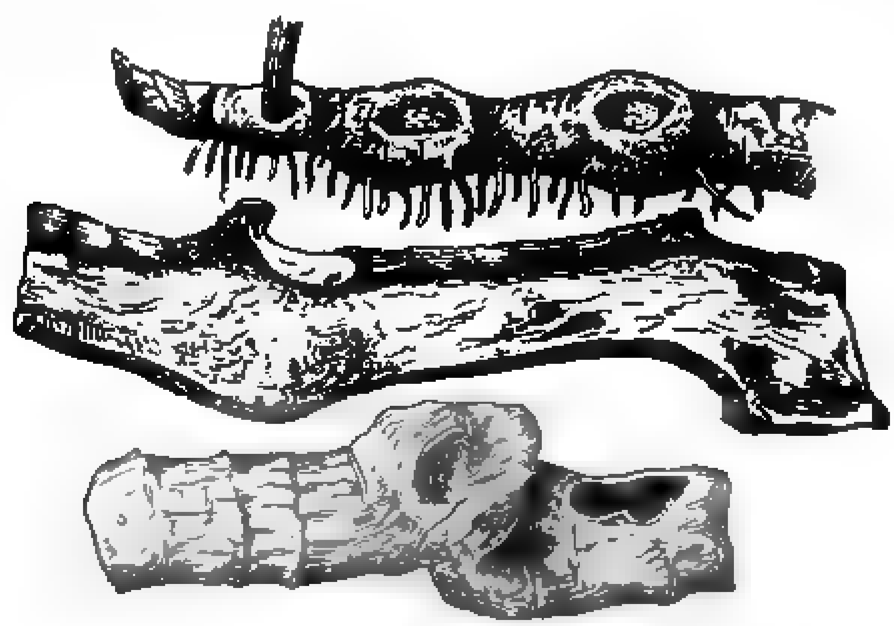


Fig. 164.

outer surface is yellowish-brown, the interior is whitish; the fracture is abrupt and somewhat spongy, showing the wood bundles mostly in the center, but without the nucleus sheath; odor none and taste mucilaginous, bitter and slightly acrid. Another much smaller form is one in which the rhizome is also about fifteen cm. long, but only about five mm. thick, not sliced, but in other regards similar to the above described variety.—**C.** Convallarin, asparagin, mucilage, etc.—**U.** Said to exert a special action on relaxed mucous membranes, as in leucorrhœa, etc. Dose: 1 to 2 grams, preferably in the form of fluid extract.

Dioscorea

N. Wild Yam.—**O.** The rhizome of *Dioscorea villosa; Dioscoraceæ.*—**H.** United States.—**D.** The shape and size of the drug are

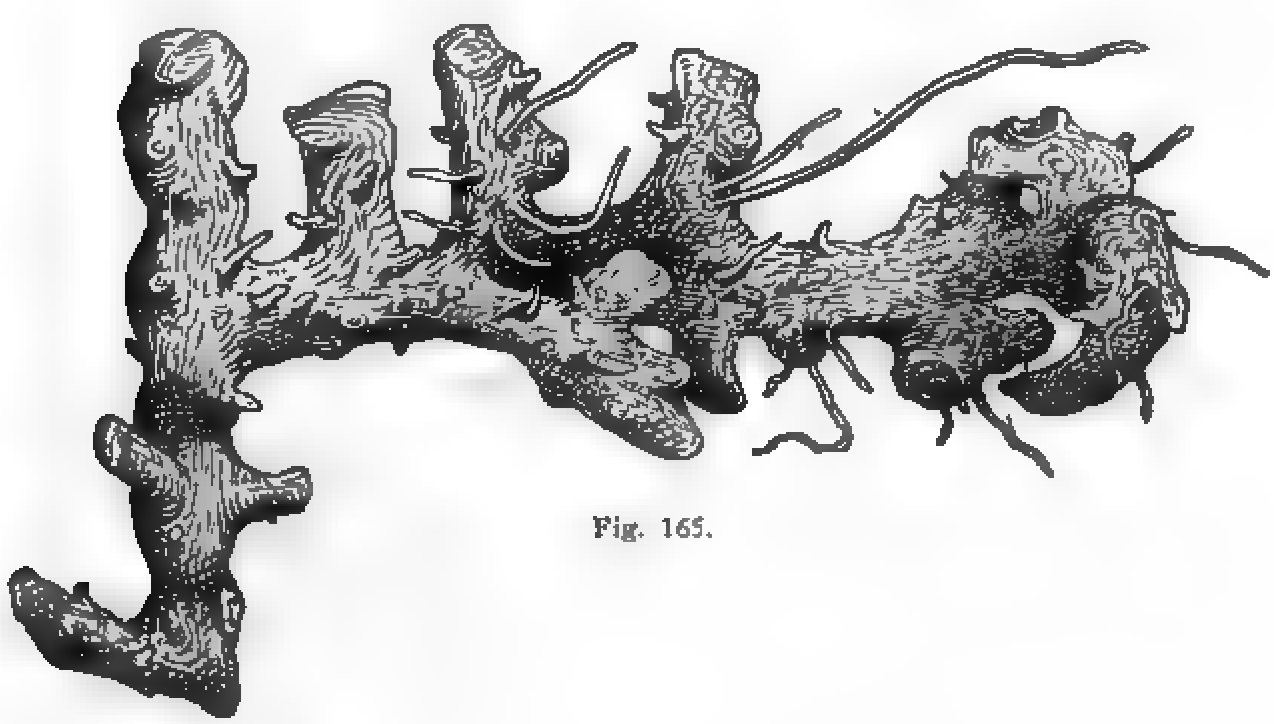


Fig. 165.

well represented in Fig. 165; crooked, branched, somewhat flattened, with few rootlets; very hard and tough, but breaks with an abrupt, somewhat fibrous fracture; pale-brown externally and white within, with yellowish wood-bundles; odorless, and taste insipidly mucilaginous but developing a slight acridity after chewing for a little while.—**C.** An acrid principle resembling saponin, resin, etc.—**U.** Said to be anti-spasmodic and anti-rheumatic; also useful in bilious colic, cholera morbus, etc. Dose: 0.5 to 2 grams.

Helonias

N. False Unicorn Root.—**O.** The rhizome of ***Chamælirium luteum*** *(Helonias dioica); Liliaceæ.*—**H.** North America.—**D.** Cylindrical, curved, with stem-scars on upper surface and occasionally with leaf-remnants at growing end, closely annulate in small pieces and more coarsely annulate in larger specimens, beset with long, wiry rootlets, which, however, are sometimes wanting in the drug; from two to seven cm. long and five to twenty mm.

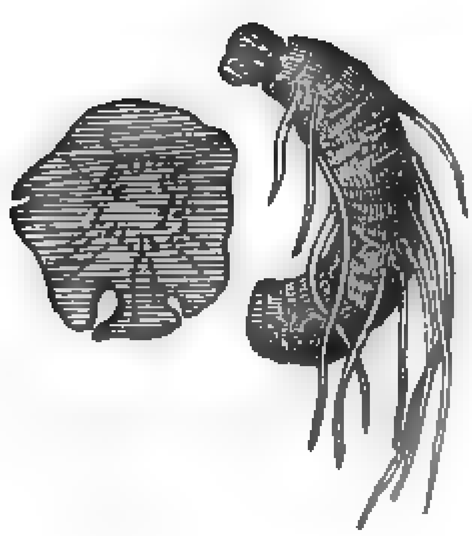


Fig. 166-*A*.

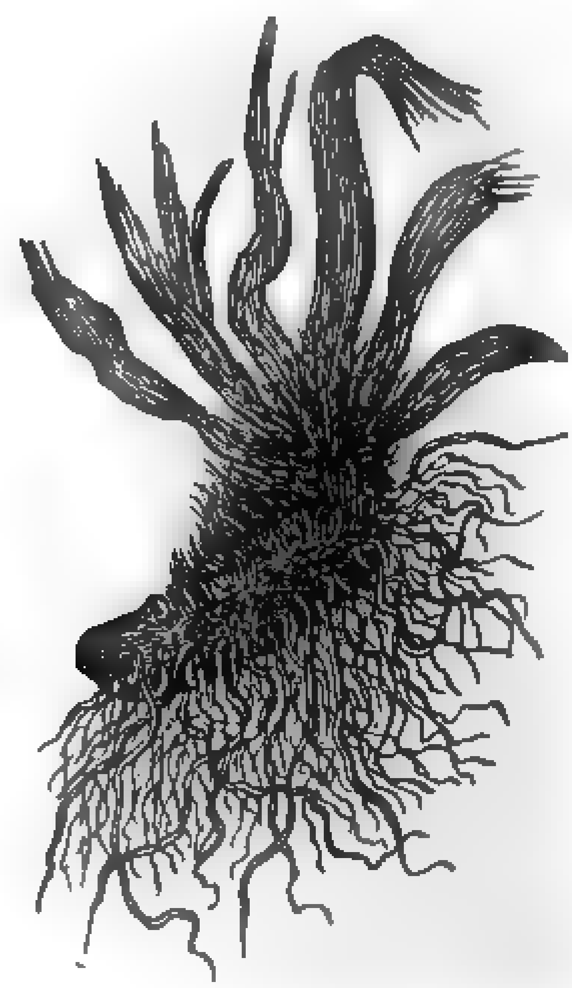


Fig. 166-*B*.

thick; externally dark grayish-brown, internally whitish and horny; fracture abrupt, showing numerous wood bundles near center; odor peculiar, though weak, but readily perceived when the drug is bruised, and the taste bitter and acrid.—**C.** Chamaelirin, etc.—**U.** Tonic, diuretic and anthelmintic. Dose: 1 to 4 grams. (See Fig. 166-*A*.)

Aletris

N. Aletris, Star Grass, Unicorn Root.—**O.** The rhizome of ***Aletris farinosa; Hæmodoraceæ.***—**H.** United States.—**D.** The rhizome

is about two to three cm. long and three to ten mm. thick, indistinctly jointed, with loose tufts of leaves and beset with numerous light grayish-yellow fibrous rootlets; externally grayish-brown, internally white, breaking with a mealy, somewhat fibrous fracture; odor none, and taste bitter.—**C.** A bitter principle.—**U.** Bitter tonic and stomachic; reputed to be a tonic to the uterus, counteracting a tendency to miscarriage. Dose: 0.5 to 1 gram. (See Fig. 166-*B*.)

Calamus

Calamus, which usually comes into trade with the rootlets removed, is occasionally found with the rootlets attached, and would then be looked for in this group of drugs. The student is referred to Group XXVI for a description of this drug.

GROUP XXIII

Di-cotyledonous Rhizomes With Rootlets; With Ducts or Oil Cells

Di-cotyledonous or exogenous rhizomes are recognizable by the arrangement of their fibro-vascular bundles; the word "duct" is used in this book to include oil, resin or latex ducts, spaces or large (special) cells. Of the three drugs mentioned in this group, one, Arnica Root, has large ducts, which are very readily recognizable, but in Serpentaria and Valerian the oil-cells are not very markedly larger than the other parenchyma cells, and although readily seen while still containing the oil, are not easily distinguished after the cell-contents have been removed, as is usually the case in finished slides, and therefore Valerian and Serpentaria are also mentioned in the next group.

Small, hard, dark brown, curved rhizome; rootlets all on lower side; a ring of ducts in the section .... **Arnica.**

Short, thick, upright rhizome, with many rootlets; with characteristic odor .... **Valeriana.**

Thin, small rhizome, with remains of stems on upper side, and many rootlets on lower side .... **Serpentaria.**

Arnicæ Rhizoma

N. Arnica Root, *Arnicæ Radix.*—**O.** The rhizome and rootlets of *Arnica montana; Compositæ.*—**H.** Europe, Asia and North America.—**D.** The drug consists of a tangled mass of rhizomes and rootlets; the rhizome is curved or contorted, up to five cm. long and two to three mm. thick, usually crowned with a tuft of leaf remnants, hard, brittle, wrinkled, annulate and nodulate with stem-remnants and leaf-scars, and the under side beset with numerous hard brittle rootlets, which are up to eight cm. long, and less than one mm. thick; the color of the rhizome is dark brown externally, with whitish bark and yellowish wood within, and with a large whitish pith; in the inner layer of the

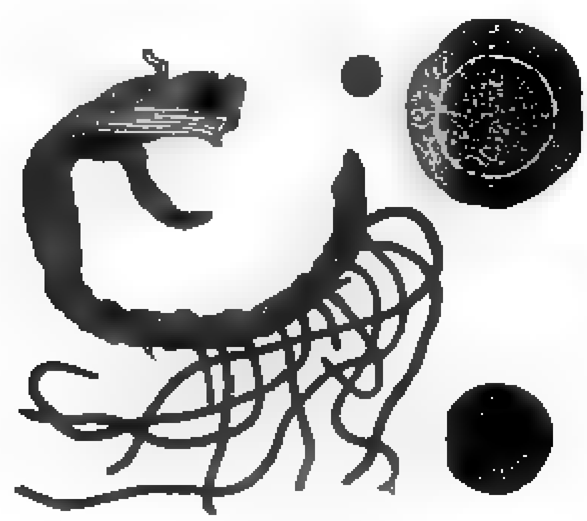


Fig. 167.

bark, surrounding the cambium, there is a circle of large resin-ducts and a similar circle of resin-ducts occurs in the rootlets; the odor is peculiar, aromatic, and the taste is acrid, aromatic and somewhat bitter. The illustration shows the rhizome in natural size, sections of the rhizome in natural size and enlarged in the upper part and a section of a rootlet in the lower part of the drawing.—**C.** Resins, volatile oil, etc.—**U.** Stimulant and vulnerary. Dose: 0.5 to 2 grams.

Valeriana

N. Valerian.—**O.** The rhizome and rootlets of *Valeriana officinalis; Valerianaceæ.*—**H.** Europe and North Asia; cultivated in New England, especially in Vermont.—**D.** The rhizome is short,

thick, upright, two to four cm. long, and one to two cm. thick, crowded with stem and leaf remnants, dark brown externally, brownish or grayish-brown, and somewhat horny within; beset with numerous deeply-wrinkled, brownish rootlets, five to ten cm. long and about two mm. thick, which are often twisted or sometimes braided into a conical or tapering compact cluster; the rhizomes are sometimes cut in halves, longitudinally, as shown in the drawing; the parenchyma cells of the bark and pith contain mainly starch, but some of them contain oil; in the bark and in the medullary rays are also larger oil-cells or glands, but in the sections from which the cell-contents have been re-

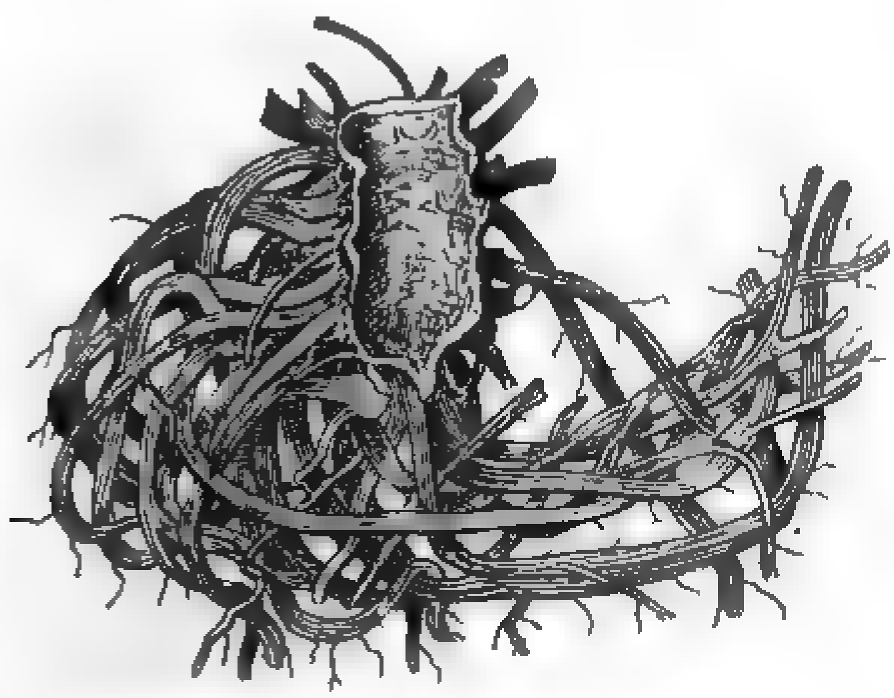


Fig. 168.

moved these oil-cells are not readily to be distinguished from the starch-cells, and the drug is therefore also enumerated in the next group; the odor is peculiar, exerting aphrodisiac effects on cats, and the taste is bitterish camphoraceous.—**C.** Volatile oil, valeric acid, etc.—**U.** Stimulant, nervine, anti-hysteric, anti-spasmodic. Dose: 1 to 5 grams.

A smaller variety of this drug which grows in dry mountainous regions is considered to be best; a larger variety, which grows in moist lowlands, is often cut into longitudinal halves, the inner surface then appearing concave on drying; this is considered to be inferior.

Serpentaria

N. Serpentaria, Virginia Snake Root.—**O.** The rhizome and rootlets of *Aristolochia Serpentaria* and *A. reticulata; Aristolochiaceæ.*—**H.** United States.—**D.** A thin horizontal rhizome, one to two cm. long and two mm. thick, curved, with the upper side closely beset with short stem-remnants and the under side with many pale-brown, brittle rootlets, five to ten cm. long and less than one mm. thick; externally pale-brown and whitish within; fracture abrupt, smooth, showing excentric wood with small pith;

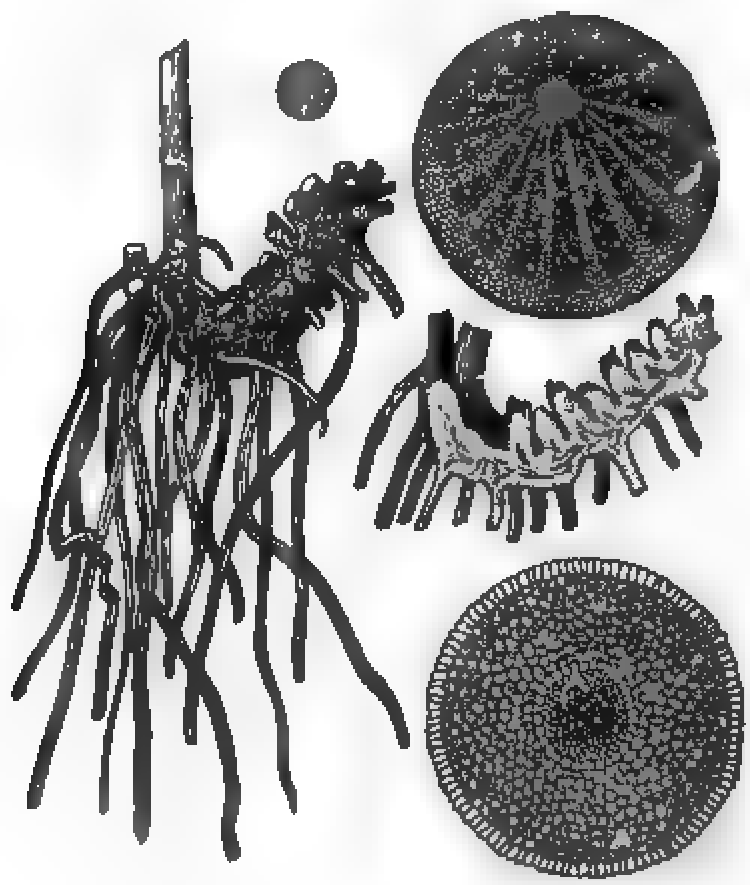


Fig. 169.

the fundamental tissue consists of parenchyma containing starch and in the bark are large oil-cells, but these cells are not sufficiently different from the adjoining starch-cells to be readily recognized when the sections have been cleared by removal of cell-contents, and this drug is therefore also mentioned in the next group; the odor reminds of a mixture of camphor and turpentine and the taste is bitterish camphoraceous.—**C.** Aristolochine, volatile oil, etc.—**U.** Stimulant, useful in typhoid conditions. Dose: 0.5 to 4 grams.

The illustrations (Fig. 169) show the rhizome, whole and lon-

gitudinal section, after soaking in water, and the transverse sections of rhizome (above) and of a rootlet (below).

The rootlets of *A. reticulata* (Texas Snake Root) are said to be coarser, longer and less interlaced than those of *A. serpentaria*. Spigelia resembles Serpentaria, but is nearly black and has circular stem-scars instead of stem-remnants. Other admixtures are readily excluded by the description of the drug.

GROUP XXIV

Di-cotyledonous Rhizomes With Rootlets; Without Ducts or Oil Cells

The drugs of this group resemble those of the last group, except that they have no latex, oil or resin ducts, spaces or large cells.

Short, thick, upright rhizome with many rootlets; with characteristic odor	**Valeriana.**
Thin, small rhizome with remains of stems on upper side, and many rootlets on lower side	**Serpentaria.**
Small, thin, knotty rhizomes, with many brittle rootlets, gamboge-colored within	**Hydrastis.**
Irregular, knotty, brownish-black rhizomes, with many rootlets which have from 3 to 6 radiating bundles	**Cimicifuga.**
Small, knotty rhizome, with several stem-scars and numerous long rootlets; grayish-brown	**Spigelia.**
Hard, irregular, bent and knotty rhizome, with broad stem-scars and numerous rootlets; yellowish-brown	**Caulophyllum.**
Rhizome a meter or more long, with small rootlets; brown or yellowish-brown	**Menispermum.**
Knotty, many-headed caudex with many rootlets; grayish or yellowish-brown externally and with white wood	**Asclepias Incarnata.**
Blackish-brown, branched and flattened rhizome, with many long and nearly black rootlets	**Leptandra.**
Thin, long, more or less contorted rhizomes; purplish-brown externally and whitish within	**Asarum.**
Much contorted, tough, knotty rhizomes, with several stems and more or less contorted roots; light-brown externally and white within	**Gillenia.**
Knotty, scaly and wrinkled rhizome, with rootlets on under side; brownish externally and whitish within	**Geum.**
Very hard, knotty and irregularly branched rhizomes, with thin and brittle rootlets; grayish-brown	**Collinsonia.**

Valeriana

This drug has already been described in Group XXIII, and the reasons were there stated why it is also mentioned here.

Serpentaria

See Group XXIII for a description of this drug.

Hydrastis

N. Hydrastis, Golden Seal.—**O.** The rhizome and rootlets of *Hydrastis Canadensis; Ranunculaceæ.*—**H.** North America.—**D.** Short, thin rhizomes, with many brittle rootlets, a large portion of the drug often consisting of broken rootlets mixed with dust or dirt; the rhizome is usually of the shape and size as shown in

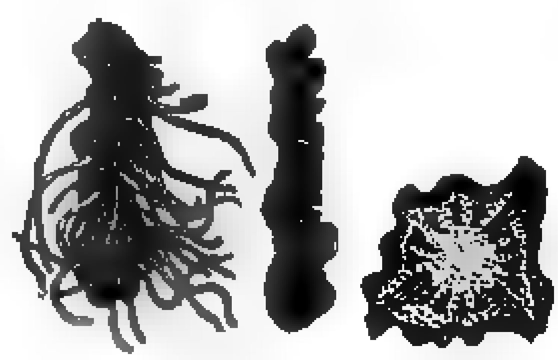


Fig. 170.

the illustration, or even thinner, but is officially described as being much larger, but pieces of the size described in the U. S. Pharmacopoeia are very seldom found now, if they occur at all; the rhizome is wrinkled longitudinally and beset with stem-remnants ending with a cup-shaped scar and with many very thin rootlets which may be up to 10 cm. long, but are usually much shorter on account of being broken; the color is brownish externally; fracture abrupt, waxy, gamboge-colored or reddish-yellow; the section of the rhizome is as shown in the drawing, all the fundamental tissue being of a yellow color; odor is slight but characteristic and the taste is bitter and slightly astringent.—**C.** Berberine, hydrastine, etc. It should contain at least 2.5 per cent of hydrastine.—**U.** Bitter tonic and alterative. Much used as an alterative local application for relaxed mucous membranes. Dose: 0.5 to 2 grams.

Cimicifuga

N. Cimicifuga, Black Cohosh, Black Snakeroot.—**O.** The rhizome and rootlets of *Cimicifuga racemosa; Ranunculaceæ.*—**H.** U. S., from Canada to Florida.—**D.** The rhizome is a rough, irregular, knobby, hard, many-headed caudex, up to 2 to 2.5 cm. thick and of various lengths, up to about 10 to 12 cm., with several stem-remnants with cup-shaped scars and numerous brittle rootlets; externally blackish-brown and grayish within, the root-

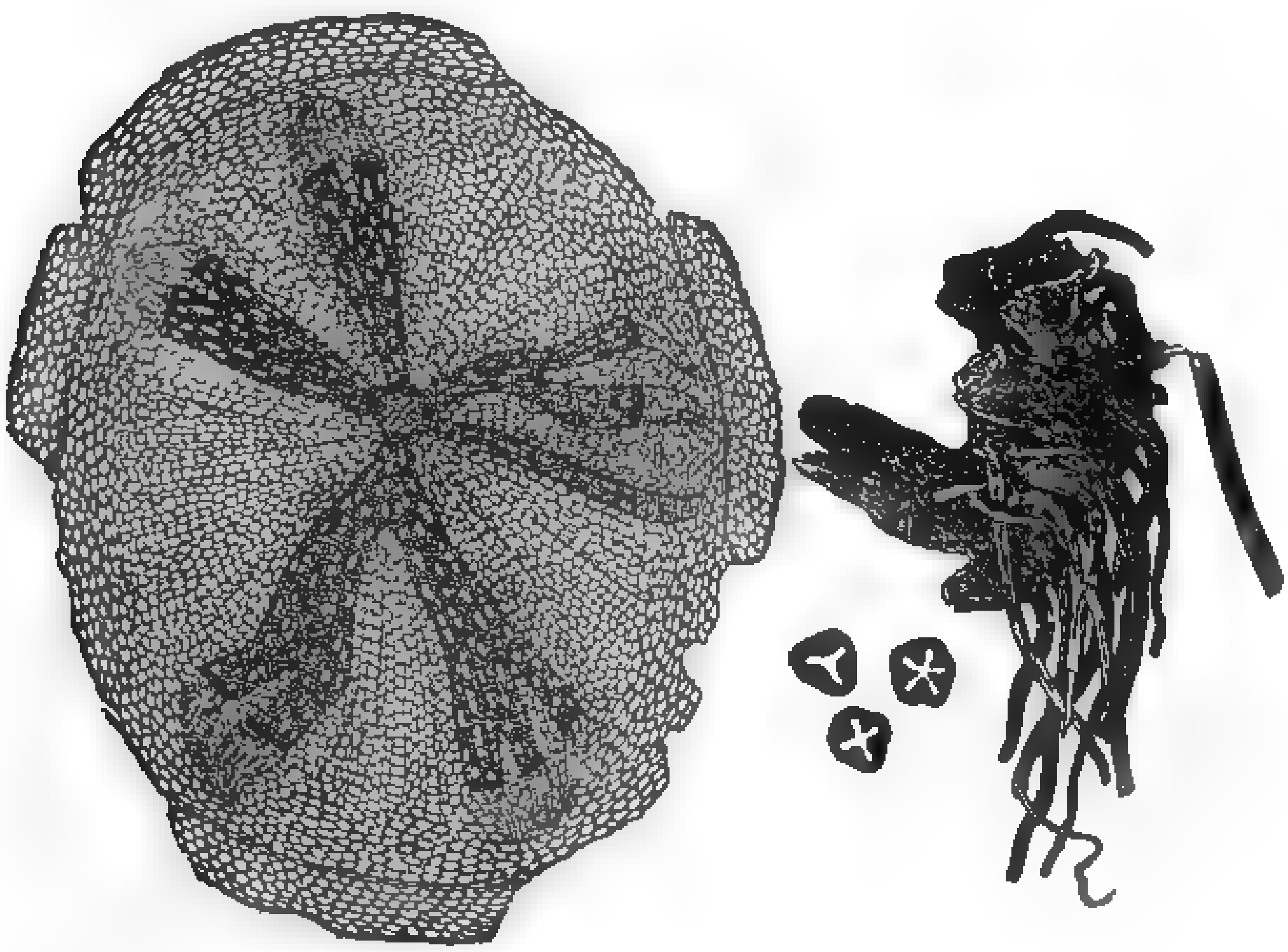


Fig 171.

lets being darker colored or almost black; the rootlets break with an abrupt fracture, showing a dark bark and a woody 3-to 6-rayed cord, as shown in the small sections and in the larger drawing of a microscopical section; odor none, and taste acrid and bitter.—**C.** The active principle is probably an amorphous resin.—**U.** Alterative, anti-neuralgic, anti-spasmodic, sedative; useful in painful disturbances of the menstrual functions. It is also used in the treatment of St. Vitus' Dance in children. Dose: 0.5 to 2 grams.

Spigelia

N. Spigelia, Pinkroot.—**O.** The rhizome and rootlets of *Spigelia Marilandica; Loganiaceæ.*—**H.** United States.—**D.** The rhizome is small, knotty, bent, somewhat flattened from the sides, about 3 to 5 cm. long, 4 mm. thick and 3 mm. wide, at the growing end sometimes branched or many-headed, with round scars on the upper side and closely beset below with numerous, thin and brittle rootlets which are about 10 cm. long; the rhizome is purplish-brown or blackish-gray externally and the rootlets are somewhat lighter-colored; fracture of the rhizome is abrupt, showing brown bark and whitish wood, the latter being horse-shoe shaped, or thicker below, and with a brown, horny pith, while the root-

Fig. 172.

lets have a central wood-cylinder and a brown, horny bark; the odor is slightly aromatic and the taste is sweetish-bitter and pungent.—**C.** Volatile oil, resin, bitter substance, etc.—**U.** Anthelmintic; to avoid toxic effects it is safe to combine it with a cathartic, as in the popular combination of Pinkroot and Senna. Dose: 2 to 5 grams.

Caulophyllum

N. Blue Cohosh, Pappoose Root, Squaw Root.—**O.** The rhizome and rootlets of *Caulophyllum thalictroides; Berberidaceæ.*—**H.** N. United States and Canada.—**D.** The drug consists of a matted and tangled mass of rhizomes and rootlets; the rhizome is hard,

irregular, bent and knotty, up to 10 cm. long and 6 to 10 mm. thick, with short, knotty branches marked with broad saucer-shaped stem-scars, the terminal joint sometimes enclosed in a yellowish-white net-work of remains of fibro-vascular bundles; the rootlets, of which but a few are shown in the drawing, are very numerous, about 10 to 12 cm. long and 1 mm. thick, tough, fibrous, and tangled or matted; rhizome grayish-brown externally, fracture abrupt, showing a whitish interior, the bark thin, the medullary rays and pith large, and the wood-bundles thin, in a circle; the rootlets have a central wood-cylinder and a relatively thick bark; odor slight or none, and taste sweetish with slightly acrid

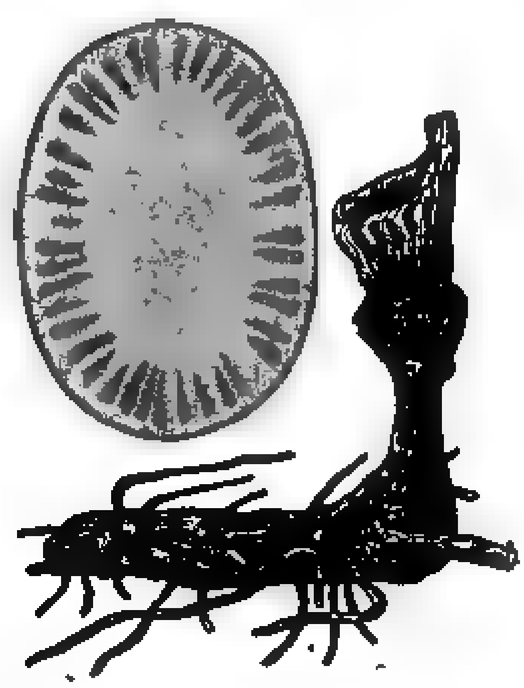


Fig. 173.

after-taste.—**C.** Leontin (a glucoside?), resins, etc.—**U.** Antispasmodic, diuretic, emmenagogue, and parturient. Dose: 1 to 2 grams.

Menispermum

N. Yellow Parilla.—**O.** The rhizomes and rootlets of *Menispermum Canadense; Menispermaceæ.*—**H.** Canada and E. United States.—**D.** Nearly cylindrical rhizomes, often a meter or more in length and usually rolled into bundles, as shown in the drawing, such bundles being of variable size, up to 10 or 15 cm. thick, or, more rarely, wound in balls; the rhizome is about 5 mm. thick, brown or yellowish-brown, longitudinally finely wrinkled and

with numerous thin and brittle rootlets; the fracture is tough and woody; the interior is yellowish, and a section shows about fourteen or fifteen porous wood-bundles, arranged slightly excentrically with the longer bundles on the under side, distinct pith and medullary rays; odor none and taste bitter.—**C.** Berberine, an

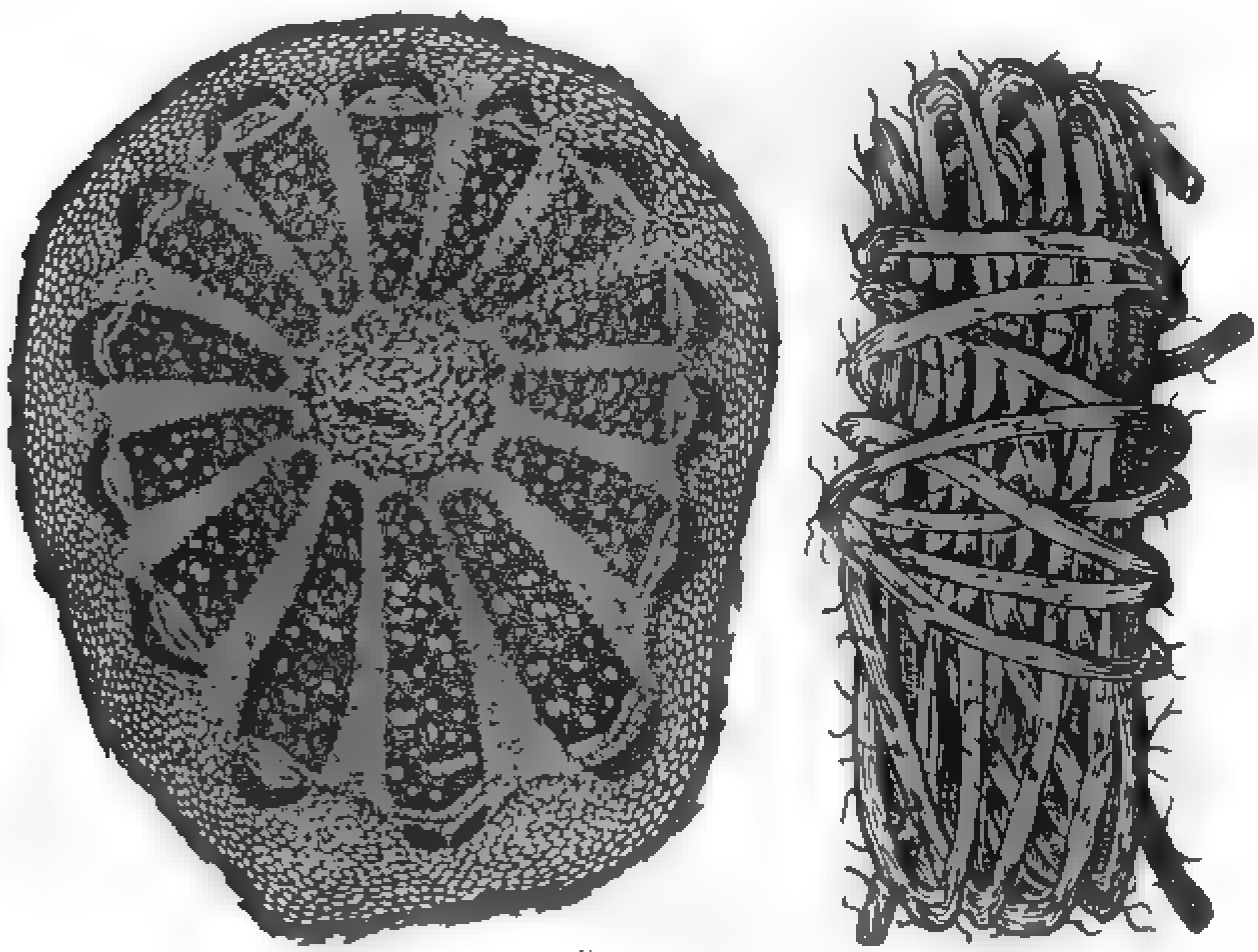


Fig. 174.

amorphous alkaloid, etc.—**U.** Supposed to resemble sarsaparilla in medicinal properties, alterative and tonic. Dose: 1 to 4 grams. Occasionally the stem is found in the trade, in similar bundles; the stem is much thicker than the rhizome, and gray, not brown.

Asclepias Incarnata

N. White Indian Hemp, Swamp Milkweed.—**O.** The rhizome and rootlets of *Asclepias incarnata; Asclepiadaceæ.*—**H.** North America.—**D.** The rhizome is many-headed, with remains of hollow stems, about 1 to 2 cm. thick, knotty, with a thin yellowish-brown bark and hard, white wood, and a brownish pith and beset with many light-grayish-brown rootlets; the rootlets are about 10 to 12

cm. long, somewhat more than 1 mm. thick and with the bark and central wood-cylinder of about equal thickness; Fig. 175 shows the whole drug with the rootlets, reduced to about two-thirds natural size (linear), and Fig. 176 shows a piece of rhizome, with

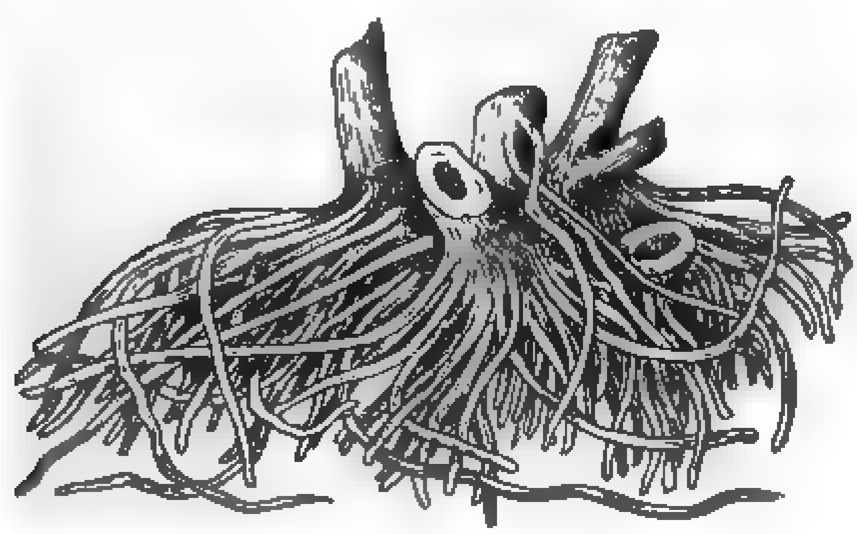


Fig. 175.

Fig. 176.

most of the rootlets broken off; no odor, taste sweetish-bitter and acrid.—**C.** Acrid resins, a glucoside, etc.—**U.** Alterative, diuretic, diaphoretic; in large doses, emetic and cathartic. Dose: 0.5 to 2.5 grams.

Leptandra

N. Culver's Root, Culver's Physic.—**O.** The rhizome and rootlets of *Veronica virginica; Scrophulariaceæ.*—**H.** North America.—**D.** The rhizome is from 10 to 15 cm. long, about 5 mm. thick, slightly flattened, bent and branched, deep blackish-brown, with cup-shaped scars on the upper side, hard and woody, the section showing a thin blackish bark, hard yellowish wood, and a large purplish-brown pith, and about six medullary rays, which are wide at the pith and become narrow toward the bark, giving the pith the appearance of a six-rayed star; the thin and wrinkled

rootlets are brittle, and have a thick blackish bark and a thin wood-cylinder; odor faint or none, and taste bitter and slightly

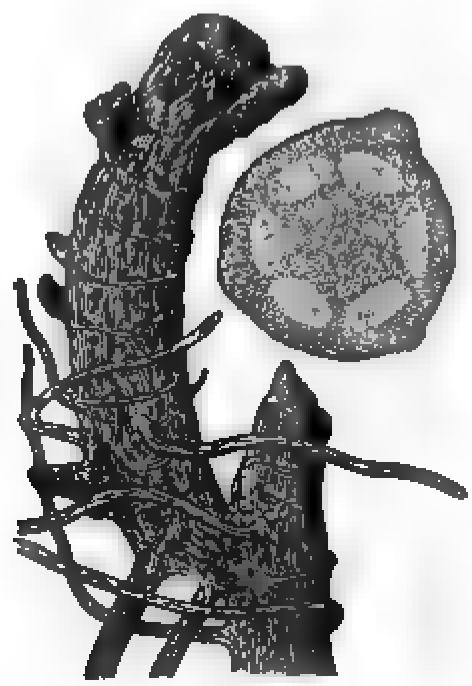


Fig. 177.

acrid.—**C**. Leptandrin, resin, etc.—**U**. Laxative, alterative tonic and cholagogue. Dose: 1 to 4 grams.

Asarum

N. Canada Snake Root, Wild Ginger.—**O**. The rhizome and rootlets of *Asarum Canadense; Aristolochiaceæ*.—**H**. North America.—**D**. From 7.5 to 15 cm. long, often broken into shorter lengths, about 3 mm. thick, somewhat contorted or bent, slightly angular

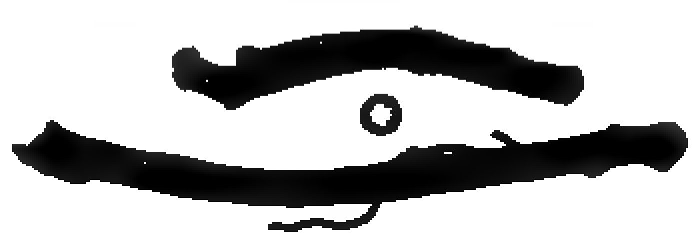


Fig. 178.

or quadrangular, finely wrinkled, with nodes about 1.5 cm. apart and with thin nearly simple rootlets at the nodes; grayish-brown or purplish-brown externally and whitish within; hard, with woody fracture; odor peculiar, aromatic, and taste aromatic, pungent and somewhat nauseous.—**C**. Volatile oil, resin, etc.—**U**. Spicy stimulant and carminative. Dose: 2 to 5 grams.

Gillenia

N. Gillenia, Indian Physic, American Ipecac.—**O.** The rhizomes and rootlets of *Porteranthus stipulatus (Gillenia stipulacea)* and *Porteranthus trifoliatus (G. trifoliata); Rosaceæ.*—**H.** United States.—**D.** The illustration shows the drug about two-thirds (linear) natural size; the horizontal knotty rhizome is from 1 to 2 cm. thick, much branched and often with stem-remnants attached, with numerous tortuous roots; both rhizome and

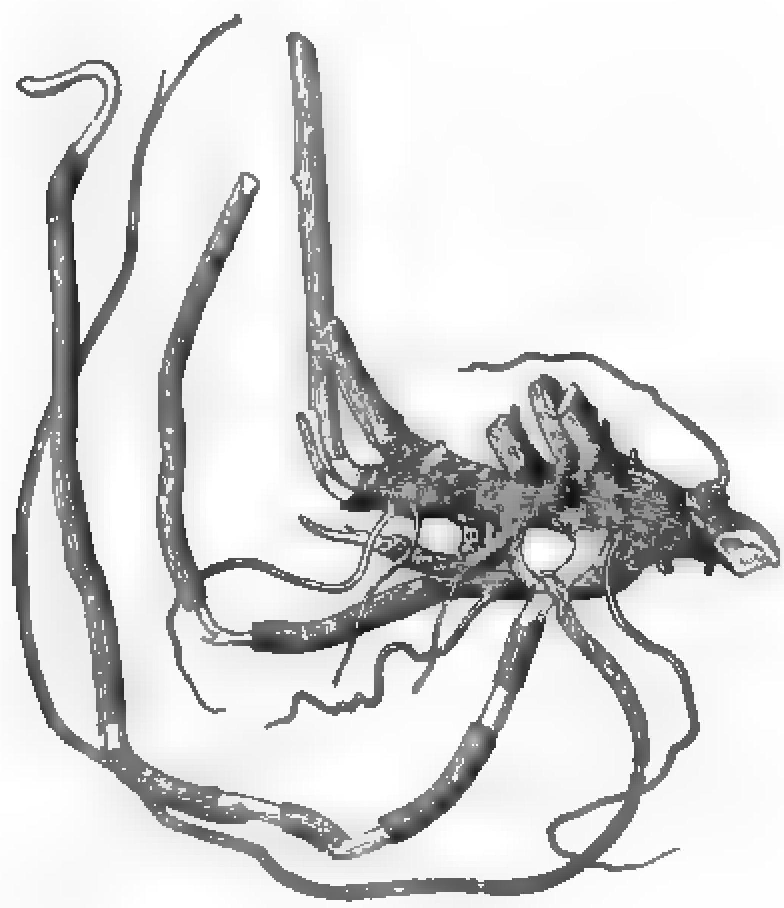


Fig. 179.

roots have a thin brownish-red bark and a tough, whitish wood; in the roots the brittle bark is often cracked off, exposing the wood, as shown in the drawing; in *Porteranthus stipulatus* the bark of the roots is irregularly thickened, causing them to resemble ipecac in the annulate appearance of the roots, but in *P. trifoliatus* the roots are less contorted and smoother, as in the accompanying figure; odor faint and taste bitter.—**C.** Two glucosides, gillein and gilleenin, resin, etc.—**U.** Mild emetic. Dose: 1 to 2 grams.

Geum

N. Avens, Water Avens.—**O.** The rhizome and rootlets of *Geum rivale; Rosaceæ.*—**H.** North America.—**D.** About 5 to 8 cm. long and about 6 mm. thick, knotty, scaly, wrinkled, with rootlets on under side, brownish or brownish-red externally as well as in the thin bark and the large pith, with a few small and widely separated whitish wood-bundles; odor slightly aromatic and taste astringent and bitter.—**C.** Volatile oil, tannin, etc.—**U.** Astringent tonic. Dose: 1 to 2 grams.

European avens, the rhizome and rootlets of *Geum urbanum,* is used like the American variety of this drug; its rhizome is thicker and shorter, about finger-thick and 2 to 5 cm. long, with a truncated head, and with rootlets about 12 cm. long and less than 1 mm. thick; tortuous, wrinkled, scaly, brittle, blackish-

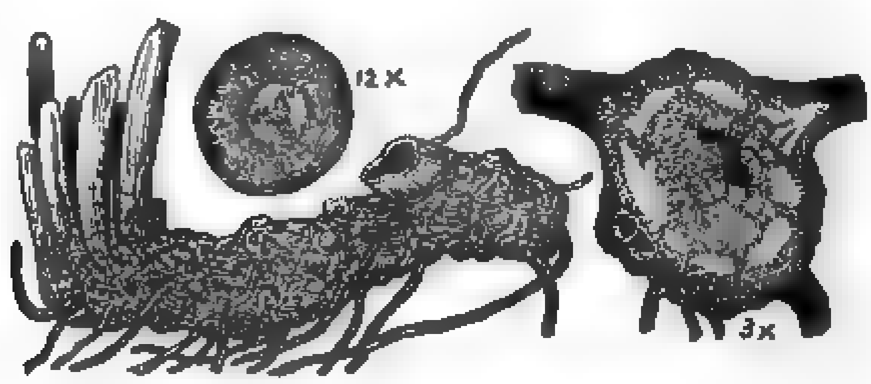


Fig 180.

brown or reddish-brown externally and flesh-colored or yellowish-white within; bark thin, wood usually in an interrupted circle and the large pith purplish brown; odor aromatic and clove-like (from which it derives its European name, *"Radix caryophyllata."),* and the taste astringent and bitter.—**C.** and **U.** like those of the American drug.

Collinsonia

N. Stone Root.—**O.** The rhizome and rootlets of *Collinsonia Canadensis; Labiatæ.*—**H.** North America.—**D.** A knotty, tubercular, irregularly branched rhizome, 7 to 10 cm. long, marked with numerous shallow stem-scars, and many thin, brittle rootlets; externally grayish-brown and internally grayish-white; very hard and tough; a section shows thin bark and irregular wood-

bundles; no odor, taste disagreeable and nauseous.—**C.** Contains resinous matter, tannin, volatile oil, etc.—**U.** Stimulant and alterative diuretic. Dose: 0.5 to 2 grams.

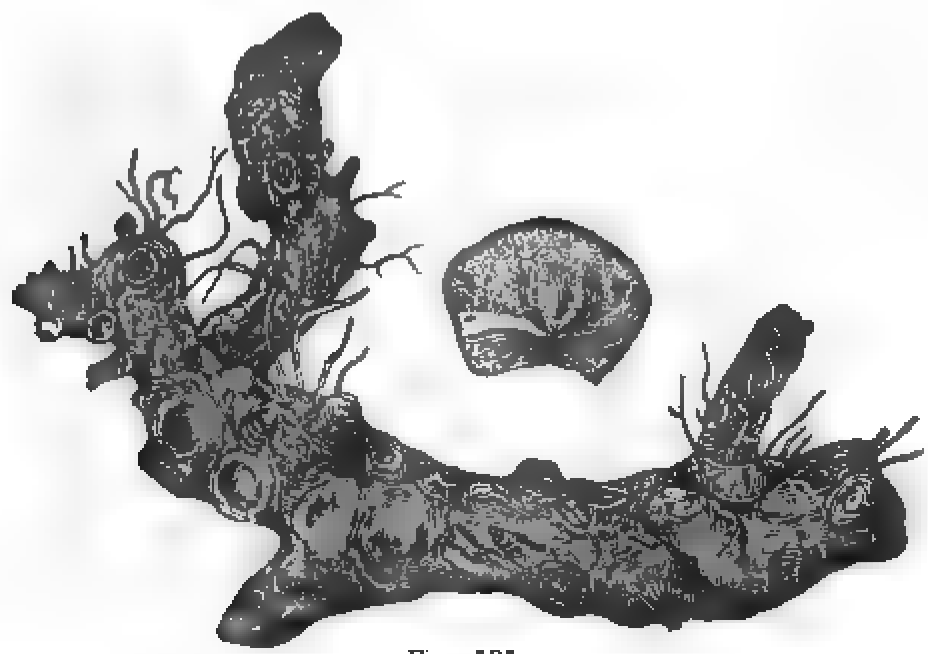


Fig. 181.

The drawing shows the upper surface of the rhizome, reduced to about four-fifths linear size; also a transverse section.

GROUP XXV

Cryptogamous Rhizomes Without Rootlets

The rhizomes of ferns have already been described in Group XV, with the other drugs which are derived from this order of plants. The acrogenous structure is so characteristic that these drugs are readily recognized.

Only two drugs are of sufficient importance to deserve mention here:

Large rhizome, beset with the bases of stipes.................. **Aspidium.**
Hard, dark-brown rhizome, beset with short remnants of stipes. **Polypodium.**

GROUP XXVI

Mono-cotyledonous Rhizomes Without Rootlets; Elongated

The endogenous structure of the drugs of this group is readily recognized by examining sections. The grouping into "elongated" and "short or compact" is rather empirical, but is prac-

tical; this group includes those in which the length is many times greater than the thickness. One of these drugs, Couch Grass, so often comes into trade cut, that it will usually be looked for in Group LXX, where it is also mentioned.

Jointed, deeply-wrinkled, flattish, grayish-brown, annulate with darker colored markings...... ....**Iris Versicolor.**
Flattish-cylindrical, reddish-brown, with root-scars in wavy lines on the under side..............................**Calamus.**
Very long, thin, straw-colored, hollow; usually cut into pieces about 1 cm. long..............................**Triticum.**

Iris Versicolor

Blue Flag has already been mentioned under Group XXII; as it comes into trade oftener with the rootlets attached than without them, the student is referred to that group for illustration and description.

Calamus

N. Calamus, Sweet Flag.—**O.** The rhizome of *Acorus Calamus; Araceæ.*—**H.** Europe, Asia and North America.—**D.** The unpeeled

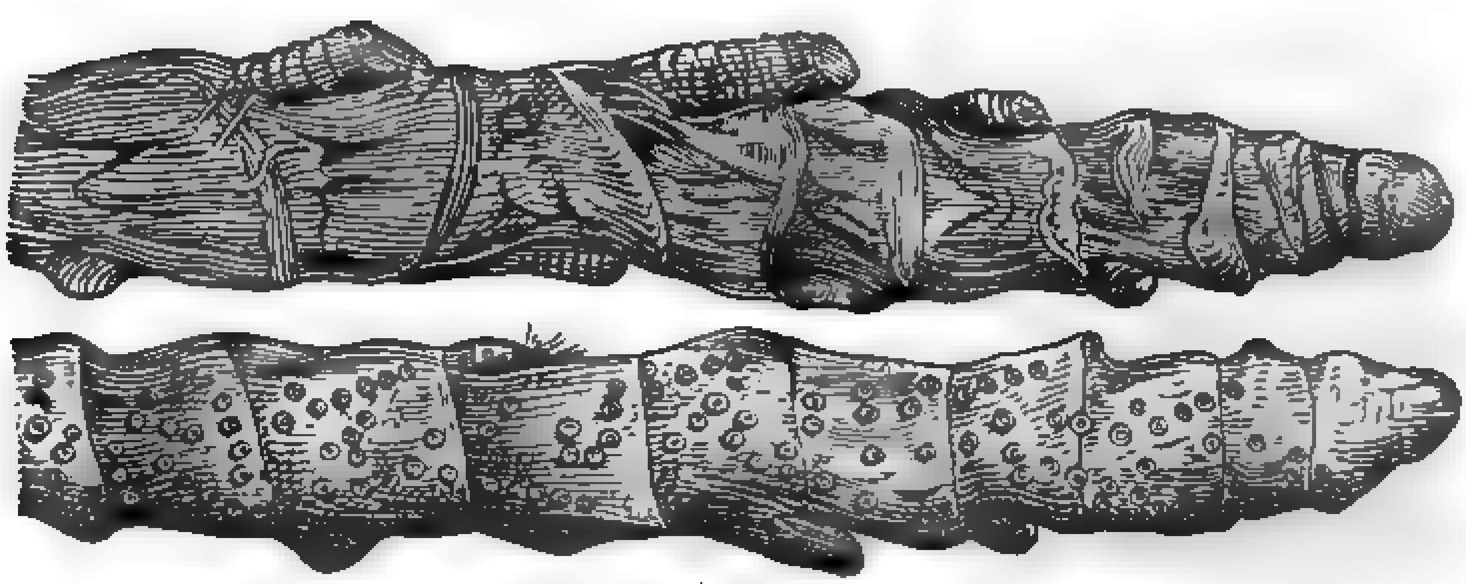


Fig. 182.

rhizome, which is the only kind that should be used, comes into trade usually in pieces 15 to 20 cm. long; it is somewhat flattened, about 2 cm. broad and 1.5 cm. thick, wrinkled longitudinally, and marked, especially on the upper surface, into wedge-shaped or obscurely triangular segments, by the darker-colored

leaf-scars, and on the under side with more or less distinctly zigzag or wavy lines of round dots or root-scars; externally reddish-brown or yellowish-brown, and reddish-white within; breaks with an abrupt corky fracture, showing an oval section with the thickness of the portion on the outer side of the nucleus sheath (often erroneously called the "bark") over one-half the shortest diameter of the portion included within the nucleus sheath, with

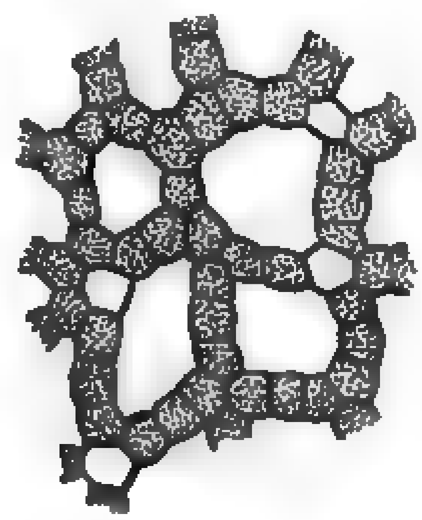


Fig. 183.

numerous brownish spots (fibro-vascular bundles) within the nucleus sheath and some also scattered outside the latter; the microscope shows the entire parenchyma or fundamental tissue to be porous on account of the large intercellular spaces, the cells in the drawing (Fig. 183) which are dotted containing starch, those which are white containing oleo-resin; odor aromatic and taste bitter aromatic.—**C.** Oleo-resin, volatile oil, etc.—**U.** Stimulant, stomachic, carminative and tonic. Dose: 1 to 5 grams.

Peeled Calamus

is also found in the trade, but as the oil and resin-cells are especially plentiful in the sub-cuticular parenchyma, and as, moreover, the thick and tough cuticle prevents both access of air and evaporation of volatile oil, the unpeeled drug is decidedly to be preferred. Peeled calamus is without the characteristic segments, although it shows traces of root-scars on the lower side; it is deeply wrinkled and sometimes sliced longitudinally, dirty or brownish-white; when fresh it looks very handsome, especially when bleached, but if bleached (with chlorinated lime or sulphurous acid) it is utterly unfit for medicinal use.

Triticum

N. Rhizoma Graminis; Couch Grass, Dog Grass, Quick Grass.—**O.** The rhizome of *Agropyron repens; Gramineæ.*—**H.** Europe and North America.—**D.** A long and branched rhizome, about two mm. thick, the internodes about seven cm. long and the nodes usually bare, but sometimes with frayed leaf-remnants, or, more rarely, with a few hair-like rootlets; smooth, but wrinkled longitudinally so as to be almost angular, hollow, of a pale straw-color, no odor, taste sweetish mucilaginous. As the drug reaches the retail pharmacist it is cut into short pieces, about one cm. long, looking much like straw chopped for fodder, and it would therefore be looked for in Group LXX, where it is also mentioned. A transverse section (Fig. 184) shows the central cavity, the diam-

Fig. 184.

eter of which is about one-third of the diameter of the rhizome; the tissues consist mainly of parenchyma, hexagonally compressed, a nucleus sheath dividing a narrow interior layer from the wider outer part; just within the nucleus sheath numerous bundles are closely aggregated, forming a cylinder, while near the outer circumference there are about half a dozen small bundles at equal distances apart.—**C.** Glucose, triticin (resembles inulin), mucilage, etc.—**U.** Demulcent diuretic, useful in irritable bladder, cystitis, etc. Dose: 5 to 10 grams in infusion or fluid extract.

The rhizomes should be gathered in the fall of the year, after vegetation ceases for the season, or in spring before it again commences, and the rootlets should be removed.

GROUP XXVII

Mono-cotyledonous Rhizomes Without Rootlets; Short and Compact

An examination of the sections shows the endogenous structure of these drugs. The group includes those endogenous rhizomes in which the length is not much more than two or three times the thickness of the drug.

Flattish, lobed, peeled or unpeeled, brownish, gray or white rhizomes .... **Zingiber.**
Cylindrical, branched, reddish-brown rhizomes, annulate with lighter-colored wavy leaf-sheaths .... **Galanga.**
Cylindrical or oval yellowish-gray rhizomes, deep orange-yellow or gamboge-colored within .... **Curcuma.**
Flat, somewhat ham-shaped, grayish or white rhizomes, often with similarly shaped smaller lobes attached.... **Iris Florentina.**
Very hard, irregular, massive tuberous rhizomes, reddish-brown, with funnel-shaped stem-scars .... **Chinae Rhizoma.**
Sub-cylindrical, curved, grayish-brown rhizome without rootlets .... **Helonias.**
Light-reddish or brownish-gray circular disks, or in longitudinal halves or quarters .... **Zedoaria.**

Zingiber

N. Ginger.—**O.** The rhizome of *Zingiber officinale; Zingiberaceæ.*—**H.** Cultivated in tropical countries.—**D.** There are several kinds of ginger in the trade, but they resemble each other in form. The rhizome is from 5 to 10 cm. long, 10 to 15 mm. broad and 5 to 8 mm. thick, flattish, clavately lobed on one side (such lobed pieces are called "race" ginger, "race" being derived from the French word "racine" or root); with or without epidermis, varying in color according to variety from dark grayish-brown to white; breaking with a somewhat fibrous mealy fracture, showing a nucleus sheath within which most but not all of the fibro-vascular bundles are found; odor aromatic and taste pungently spicy.—**C.** Volatile oil, resin, etc—**U.** Carminative stimulant, used for flavoring. Dose: About 1 gram.

Cochin Ginger (Fig. 185) is the variety that best answers the description of the U. S. Pharmacopoeia; pale-buff-colored or yellowish, with short lobes and somewhat striate; it makes a beauti-

ful light-yellow powder and has a strong but agreeable flavor and taste.

Jamaica Ginger is whitish externally and internally and has long lobes; the epidermis is removed and it is often coated with a white powder of carbonate of lime from having been immersed in milk of lime. The smaller drawing in Fig. 186 shows this variety, but while the lobes are usually small, the specimens may some-

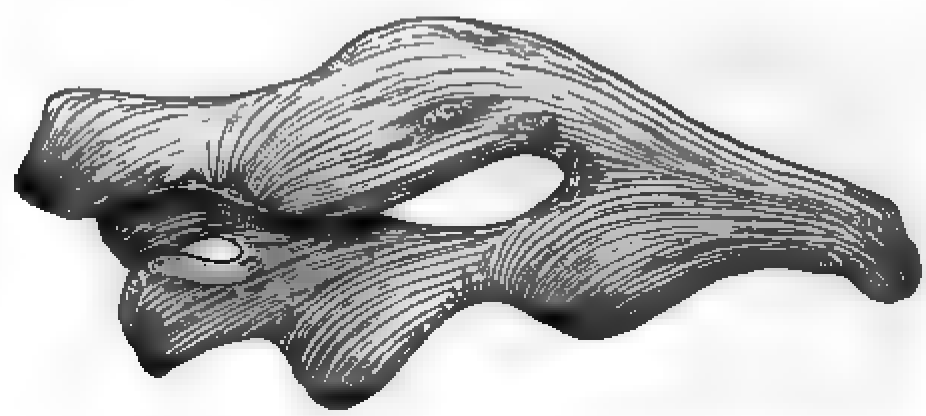


Fig. 185.

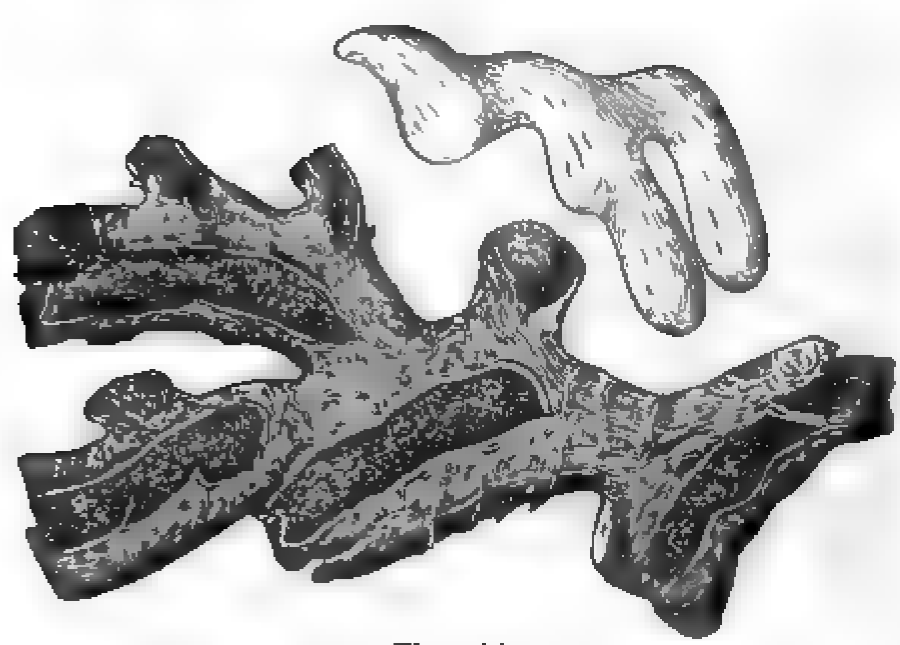


Fig. 186.

times be as large as the Cochin ginger. This variety has the most pleasant flavor and is therefore preferred for culinary purposes.

African Ginger is an unpeeled ginger; it is illustrated in the lower drawing of Fig. 186; it has short lobes and the epidermis is dark grayish-brown with peculiar darker patches as if torn on one side. It has a stronger though less agreeable taste than the other gingers.

A preserved ginger, made by boiling the fresh rhizomes in a

concentrated syrup and then packing in jars, is to be found in the grocery trade.

Green ginger is ginger sent into trade in a fresh condition.

Black ginger is ginger which has been boiled in water and then dried; it is dark colored and horny within. The term is also sometimes applied to "unpeeled" ginger.

Coated ginger is ginger retaining its epidermis, in other words, unpeeled ginger. *Peeled* ginger is without epidermis. *Natural* or *unbleached* ginger has no lime attached; bleached ginger is whitened by immersing in milk of lime or chlorinated lime and retains a coating of powder of carbonate of lime.

Galanga

N. Galangal.—**O.** The rhizome of *Alpinia officinarum; Zingiberaceæ.*—**H.** China.—**D.** Knotty, often branched, cylindrical, about

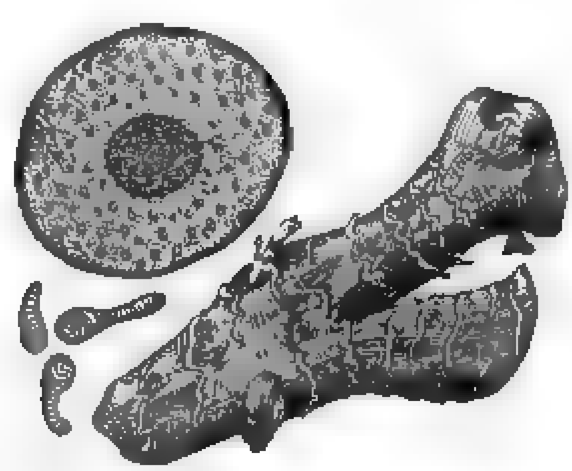


Fig. 187.

5 to 6 cm. long and about finger-thick, frequently curved, truncated at the ends, externally light red-brown, finely wrinkled lengthwise, marked by wavy transverse rings from remnants of leaf-scales or sheaths, hard, brittle with short fracture, cinnamon-brown and showing structure as in Fig. 187, which also shows a few starch grains; under the microscope numerous brownish-yellow resin-cells are to be seen; odor aromatic, especially when freshly ground, and taste pungently spicy.—**C.** Volatile oil and resin.—**U.** Similar to those of ginger. Often sold by street fakirs as a secret catarrh cure, to be grated and used as a snuff; thus used it is sternutatory.

Curcuma

N. Curcuma, Turmeric.—**O.** The rhizome of *Curcuma longa; Zingiberaceæ.*—**H.** Southern Asia.—**D.** Oblong or oval, from 3 to 5 cm. long and about half as thick, being then called "round turmeric," or only about 1 cm. thick, when it is called "long turmeric," but most pieces are much smaller; sometimes cut longitudinally or transversely, somewhat annulate and with large scars; externally yellowish-gray and internally deep orange-yellow or brownish-yellow, resembling the color of whole gamboge; fracture abrupt, resinous and glossy, showing a nucleus sheath with bundles both within and without the sheath; odor

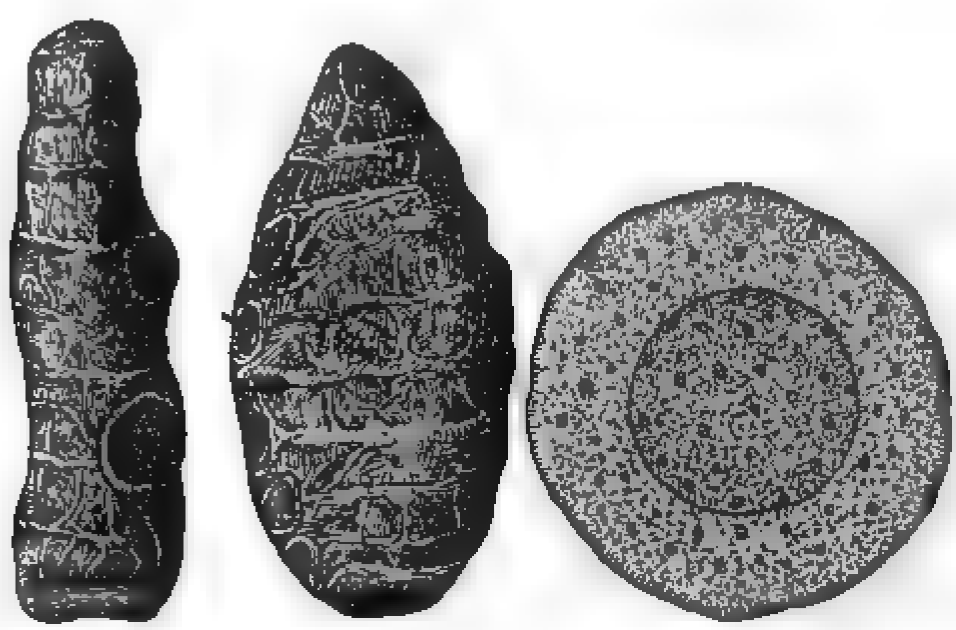


Fig. 188.

slight and ginger-like, taste warm, bitter, aromatic. The powder is rich deep yellow and turns brown with alkalies and borax.—**C.** Volatile oil, resin, and an orange-yellow, resinous coloring matter called *curcumin,* which in solution has a greenish fluorescence.—**U.** Stimulant carminative, but rarely employed internally; used mainly as a coloring agent and as a spicy addition to various pickles.

In the trade distinction is made between *light* and *dark* turmeric (or *yellow* and *red* turmeric), and between *long* and *round* turmeric.

Of the varieties in our markets Madras Turmeric is best; it is generally large and orange-yellow, and somewhat rough externally.

Bengal Turmeric is gray externally and smoother than the

Madras variety, and has a darker red color within. It is also smaller and more slender.

CHINESE TURMERIC is the best, but is not often found in our markets.

JAVA TURMERIC is rather small and usually cut tranversely and longitudinally; also rare in our trade.

Powdered turmeric is occasionally used as an adulterant to spices, drugs, etc., to impart a fresh color. The shapes of its cells, starch and ducts therefore deserve special study.

Iris Florentina

N. Orris Root, Florentine Orris; its German name is *Veilchenwurzel* (violet root) on account of its violet-like odor which is utilized in the manufacture of perfumeries.—**O.** The rhizomes of *Iris Florentina; I. pallida* and *I. Germanica; Iridaceæ.*—**H.** Northern Italy; cultivated.—**D.** Simple or branched, flattened, jointed, 5 to 10 cm. long and about 2.5 cm. broad; with a circular scar at the upper end and with numerous round brownish root-scars on the lower side, and small marks of bundles on the upper side; wrinkled lengthwise, or smooth and somewhat angular from being peeled; externally whitish or yellowish-white heavy, hard, with fracture short and mealy; section long oval, with nucleus sheath near the outer surface and most marked on lower half, and fibro-vascular bundles within the sheath; odor violet-like and taste insipid, afterward bitter and slightly acrid.—**C.** Volatile oil, acrid resin, etc.—**U.** Seldom employed internally. It is said to be an alterative cathartic and diuretic. Used mainly in the preparation of perfumery, flavoring extracts, etc.

FLORENTINE ORRIS is mainly from *Iris pallida,* and *I. Germanica,* but is named "Florentine" because it is cultivated near the city of Florence in Italy. It is considered better than the Veronese varieties, although the latter are obtained from the same plants. VERONA ORRIS is of a more yellowish color.

FINGER ORRIS (right-hand drawing in Fig. 189) consists of picked, slender, nearly straight pieces, smoothly trimmed in uniform size and shape and usually whitened with chalk, magnesia or starch. Usually with a hole drilled through one end. As only choice pieces of the rhizome of Florentine Orris can fur-

nish this kind of orris, it is sometimes considered to be a better variety than the ordinary drug; but for perfumery, etc., it is altogether unnecessary to use this drug. It is used only for

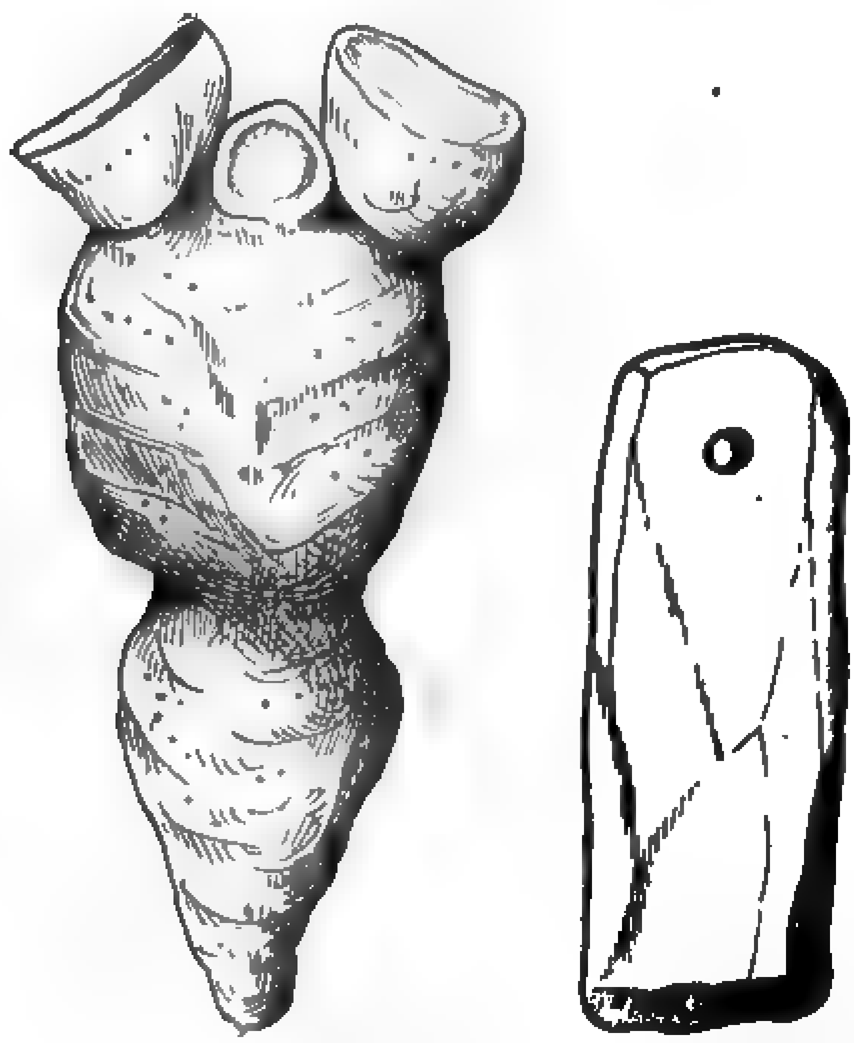


Fig. 189.

teething infants, but the rubber ring is better and more cleanly.

Orris Root is frequently worm-eaten. Only sound pieces of good odor and light color should be used.

Chinae Rhizoma

N. China Root.—**O.** The rhizome of *Smilax China; Liliaceæ.*—**H.** China and Japan.—**D.** Stout fibrous tubers, 5 to 20 cm. long and 2 to 6 cm. thick, knotty, dense, tough, externally reddish-brown, with several deep, circular, funnel-shaped stem-scars on the upper surface; internally pale-pinkish or pale brownish-white, darker towards the center on account of numerous dark-brown resin cells; inodorous; taste at first insipid, afterwards

bitterish; slightly astringent and acrid.—**C.** Similar or identical with those contained in sarsaparilla.—**U.** Same as those of sarsa-

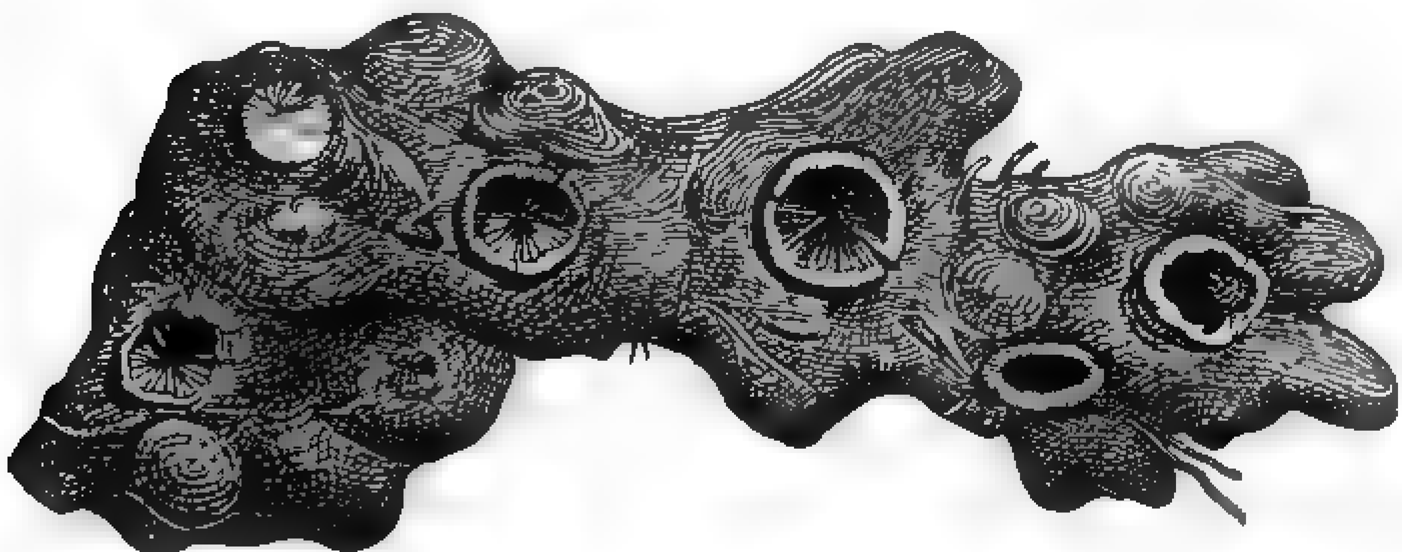


Fig. 190.

parilla; alterative. Dose: 2 to 5 grams several times a day, best given in form of fluid extract.

Zedoaria

N. Zedoary.—**O.** The tuberous rhizome of *Curcuma Zedoaria; Zingiberaceæ.*—**H.** India, Bengal and Madagascar.—**D.** The whole rhizome is ovoid, about 4 cm. long and 3 cm. thick, orange-

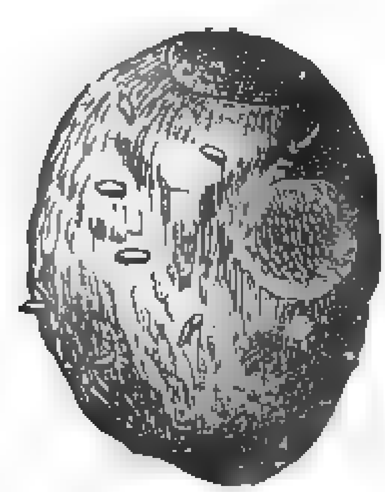


Fig. 191.

brown; but the drug usually comes into the trade in circular slices or disks, with the cut surfaces pale grayish-brown with a somewhat waxy appearance, and showing a nucleus sheath near the outer circumference; odor and taste similar to those of

ginger.—**C.** Resin, ½ to 1% volatile oil, etc.—**U.** and dose similar to those of ginger.

Helonias, or False Unicorn Root, usually has rootlets attached, and was described on page 222; occasionally it is without rootlets, and then belongs here.

GROUP XXVIII

Exogenous Rhizomes Without Rootlets; Long

Drugs of this group are many times longer than they are thick; some of them occasionally, though rarely, come into trade with rootlets attached.

Rhizomes with thickened nodes, with stem-scars above and root-scars below; glossy brown, whitish within... **Podophyllum.**
Cylindrical, annulate, light, pithy, grayish-brown; bark exfoliating .... **Aralia Nudicaulis.**

Podophyllum

N. Mandrake, May Apple.—**O.** The rhizome of *Podophyllum peltatum; Berberidaceæ.*—**H.** North America.—**D.** Somewhat variable in size, consisting of joints about 5 to 8 cm. long, the nodes

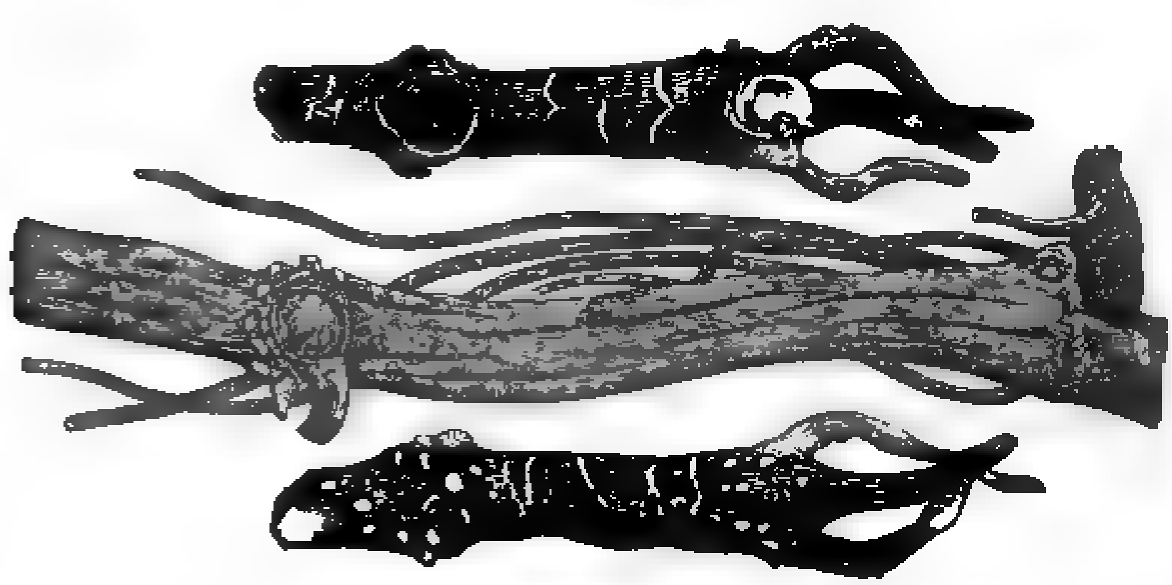


Fig. 192.

thickened, with a well-marked stem-scar on the upper surface and white root-scars on the lower surface; the internodes from 5 to 10 mm. thick, the thinner predominating, and without root-

scars; the end terminates in a scar and often is branched, and it is also somewhat larger than the other parts of the rhizome, as is shown in the drawings; smooth, or longitudinally wrinkled;

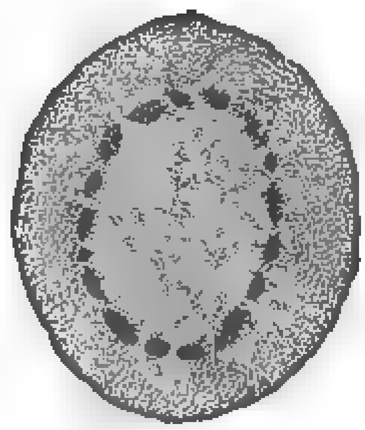


Fig. 193.

orange-brown externally and white within; breaks with an abrupt, usually white, mealy fracture, so that a section is required to show the fibro-vascular bundles of which there are about sixteen arranged in a circle (see Fig. 193); no odor; taste at first sweetish, then bitter and acrid.—**C.** Resin, called "podophyllin" in the trade. The drug is very variable in quality, and its value depends directly on the amount of "podophyllin" which it yields; there should not be less than three per cent of this substance, which, however, is not a pure resin, but a mixture of several compounds, such as podophyllinic acid, podophyllotoxin, picropodophyllin, etc.—**U.** Emetico-cathartic in large doses; in medicinal doses it is a reliable cathartic, supposed also to possess alterative and cholagogue properties. Dose: 0.3 to 2 grams. (Fig. 193.)

Aralia Nudicaulis

N. American Sarsaparilla, False Sarsaparilla (Fig. 194.)—**O.** The rhizome of *Aralia nudicaulis; Araliaceæ.*—**H.** North Amer-

Fig. 194.

ica.—**D.** Cylindrical, 30 cm. or more in length, but usually broken into shorter pieces, about 6 mm. thick, longitudinally wrinkled,

annulate above, with cup-shaped scars from stems; rootlets usually altogether absent; bark grayish-brown, exfoliating; internally white or pale yellowish, with a large spongy pith; odor slightly aromatic and taste insipid, somewhat disagreeable.—**C.** A little volatile oil, resin, etc.—**U.** Alterative. Dose: 2 to 5 grams.

GROUP XXIX

Di-cotyledonous Rhizomes Without Rootlets; Short and Compact

The length of these drugs is only three or four times greater than their diameters; the exogenous structure is easily recognized in a prepared section, or even in the end of a piece of the drug soaked in water and cut through smoothly with a sharp knife.

Flattened, bent upon itself, or broken, dark-brown, hard....... **Bistorta.**
More or less curved and somewhat flattened pieces, with closely set, large cup-shaped stem-scars; brownish................ **Scopola.**
Dark reddish-brown rhizome, somewhat flattened, much wrinkled and twisted .... **Sanguinaria.**
Hard, compact, contorted and tuberculated, umber-brown...... **Geranium.**
Simple, cylindrical or flattened, externally rough and grayish-brown .... **Tormentilla.**
Dark-brown, knotty, flattened, with root-scars and transverse rings .... **Imperatoria.**

Bistorta

N. Bistort.—**O.** The rhizome of *Polygonum Bistorta; Polygonaceæ.*—**H.** Asia, Europe and America.—**D.** The whole rhizome is about 15 cm. long, 16 to 18 mm. broad and 1 cm. thick; firm, hard, S-shaped or bent twice upon itself, as shown in the drawing (whence the name, *bis,* twice, and *torta,* twisted or bent), flattened on one side, plump and rounded on the other; marked by transverse striæ on the upper surface, and with root-scars on the lower side; externally dark-brown or almost black; breaks with abrupt fracture, and in fact usually comes into trade broken at the places where it is bent, so that it appears to consist of short

straight pieces; internally brownish-red; thick bark, small bundles in a circle, and very large pith; no odor, but taste very astringent.—

Fig. 195.

C. About 20 per cent tannin.—**U.** Simple astringent. Dose: 1 to 2 grams.

Scopola

N. Scopola.—**O.** The rhizome of *Scopola Carniolica; Solanaceæ.*—**H.** Southwestern Russia, Austria, etc.—**D.** In pieces from 2.5 to 7.5 cm. in length and up to 1.5 cm. in thickness; sometimes split lengthwise; irregular in shape, often much bent; slightly flattened vertically, and with closely set, large, cup-shaped stem-scars on the upper surface; hard, with brittle fracture; brownish or brownish-gray externally, whitish within; finely and irregu-

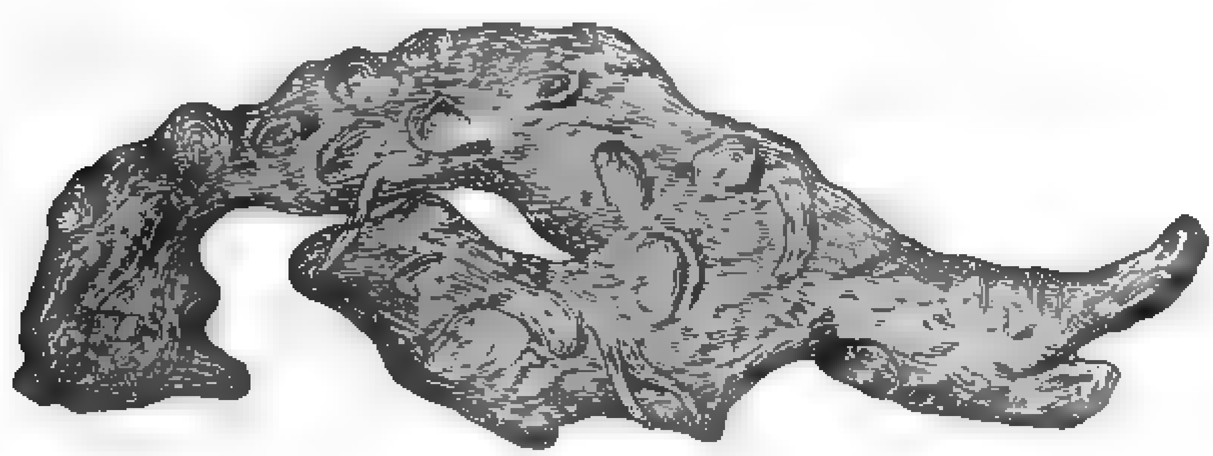


Fig. 196.

larly wrinkled; little odor; taste at first sweetish, afterwards bitterish and acrid.—**C.** An alkaloid, scopolamine, which is identical with hyoscine.—**U.** Used like belladonna; for the manufac-

ture of mydriatic alkaloids of which it should contain at least 0.5 per cent. Dose: About 0.045 gram.

Introduced in the VIII Revision of the U. S. P., it has been dropped in the IX Revision. It is only used by manufacturers of alkaloids, belladonna plasters, etc., but has not been used in galenical preparations.

Sanguinaria

N. Blood Root.—**O.** Rhizome of *Sanguinaria Canadensis; Papaveraceæ*. It should be collected in autumn.—**H.** North America.—**D.** The rhizome is in pieces about 5 to 7.5 cm. long, 1 to 2 cm. thick, somewhat flattened, slightly annulate, much wrinkled and twisted, or broken, often with abrupt offsets or branches, and sometimes with very brittle rootlets; dark reddish-brown externally; fracture ab-

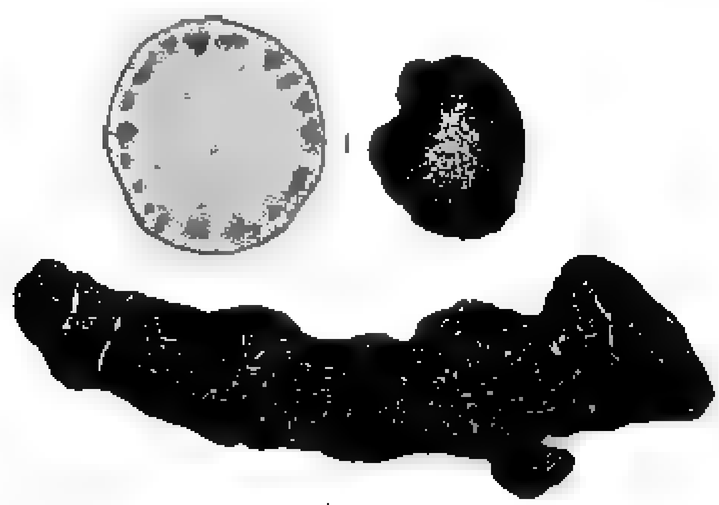


Fig. 197.

rupt, somewhat waxy, in fresh pieces whitish with red dots, in older pieces, brownish-red; odor slight and taste bitter and acrid.—**C.** The alkaloid sanguinarine, one or two other unimportant alkaloids, resin, etc.—**U.** In large doses, emetic; in smaller doses, stimulant and tonic. The powder is sometimes used as an errhine and sternutatory. Dose: 0.1 to 1 gram.

The illustration shows the whole drug, natural size; transverse section of soaked rhizome, and the same after clearing with dilute lye.

Geranium

N. Geranium, Cranesbill.—**O.** Rhizome of *Geranium maculatum; Geraniaceæ*.—**H.** North America.—**D.** Cylindrical, sometimes

branched, 5 to 7 cm. long and about 1 cm. thick, contorted and tuberculated, hard and compact; longitudinally wrinkled; externally dark umber-brown; fracture short, showing pale red-brown

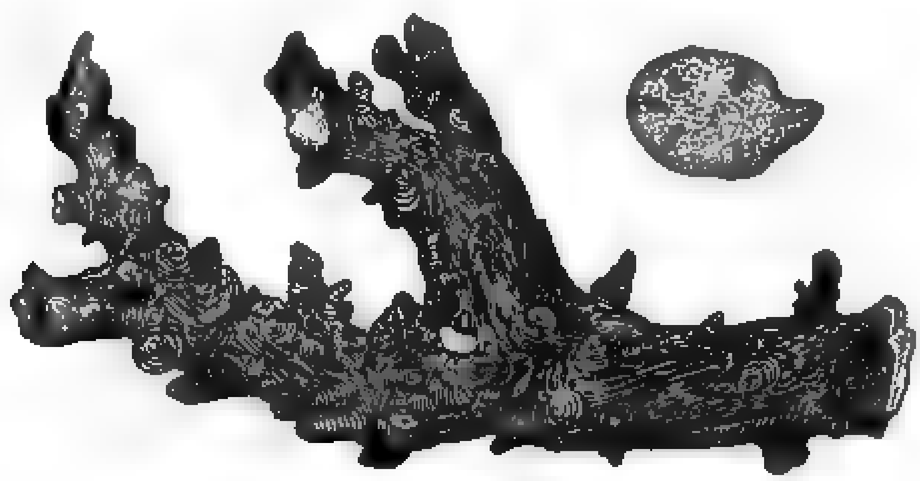


Fig. 198.

broken surface; inodorous; taste pure astringent without disagreeable other taste.—**C.** From 15 to 25 per cent tannin, etc.—**U.** Astringent tonic. Dose: 1 to 4 grams.

Tormentilla

N. Tormentil.—**O.** Rhizome of *Potentilla Tormentilla; Rosaceæ.*—**H.** Europe.—**D.** Simple or sometimes branched, cylindrical or flattened, tapering; 5 to 8 cm. long and about 15 mm. thick, but often broken into shorter lengths; roughly marked by roundish elevations and ridges and with the scars of stems and rootlets; exter-

Fig. 199

nally dark grayish-brown; very hard and compact, but breaks with abrupt and slightly fibrous fracture, showing light brownish-red interior; bark thick; wood-bundles small; pith about same thickness as the bark; no odor; taste astringent.—**C.** About 25 per cent tannin.—**U.** Astringent, tonic. Dose: 1 to 5 grams.

Imperatoria

Masterwort is sometimes classed among the rhizomes, but belongs more properly among the roots, where it has already been described and illustrated. The student is referred to Group XX for a consideration of this drug.

TUBERS OR CORMS

While tubers and corms resemble each other, a distinction may be made between them botanically, although it is not of much consequence as far as pharmacognosy is concerned.

A tuber is a thickened and short rhizome or root-stock; it usually has several internodes and therefore may have a number of lateral buds, as well as a terminal bud, as for instance in the potato.

A corm is a very short, thickened, compact, fleshy, generally leafless underground stem or branch, often much thicker than it is long, which also produces buds, terminal or lateral or both; it sometimes consists only of one internode, in which case it produces only the terminal bud; when it consists of several internodes it may have lateral buds, occurring in the axils of leaves, which sometimes surround the corm as a membranous envelope. Sometimes the corm is the dilated base of the annual stem, as in Turkey Corn.

The tuberous roots, as of aconite and jalap, are by some authors classed as tubers, but as they are really roots and not enlarged stems, and do not produce buds, although a small portion of adhering stem may have buds and may therefore permit of growth, as in aconite, the tuberous roots belong with the fleshy roots and not with the tubers or corms.

Both corms and tubers may have traces of scaly leaves or leaf-scars on the sides or above and either rootlets or root-scars below.

Some authors class corms and tubers with bulbs, considering that the presence or absence of fleshy leaf-bases is of insufficient importance to make a division. Other authors class corms and tubers, as well as bulbs, with the "*gemmæ*" or leaf-buds, considering the corms solid buds, the bulbs to be fleshy buds, while the leaf-buds are scaly buds. But corms and tubers are sufficiently distinct from the other structures mentioned, that they may

readily be distinguished from them, as well as from short rhizomes, which they also somewhat resemble, and they are therefore separately grouped here.

Both tubers and corms are commonly called "roots" in the trade, yet for the purposes of the pharmacognosist a distinction must be made and their real nature must be borne in mind.

Corms and tubers may be divided:—

Corms and tubers	Whole	30
	Sliced	31

GROUP XXX

Whole Tubers and Corms

Hard, tuberous, irregularly round or pear-shaped, dark brown.... **Jalapa.**
Conical, blackish-brown, tuberous roots, single or joined in pairs.. **Aconitum.**
Ovoid, brownish, wrinkled corms, with a groove on one side...... **Colchicum.**
Single, round, small, hard, semi-translucent or opaque, yellow or brown tubers; sometimes two tubers joined with a smaller third one between.......... **Corydalis.**
Oval, slightly flattened or shrunken, semi-translucent and very hard .... **Salep.**

Jalapa

On account of the general habit of calling the pieces of jalap "tubers," many students would naturally look here for this drug, and might be puzzled if they found no mention of it. Jalap consists of tuberous roots and is therefore described with the fleshy roots. (See Group XX.)

Aconitum

The remarks just made in reference to jalap apply also to this drug. (See Group XX.)

Colchicum

Occasionally the whole tubers of Colchicum occur in the trade or an occasional whole tuber may be found in the sliced corms as ordinarily sold. But Colchicum is usually sliced and is therefore described in the following group. (See Group XXXI.)

Corydalis

N. Turkey Corn, Turkey Pea, Squirrel Corn.—**O.** The tubers of *Dicentra Canadensis (Bicuculla Canadensis); Papaveraceæ*.—**H.** North America, north of Kentucky.—**D.** Round, from 3 to 12 mm. in diameter, resembling tears of inferior acacia gum; of a tawny yellowish color, internally yellowish-white, semi-translucent; some tubers are dark brownish, opaque, and vary in size from 12 mm.

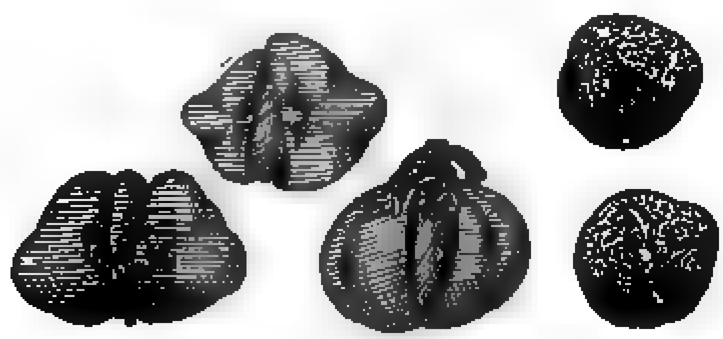


Fig. 200.

diameter down to the size of barley grains; still other tubers consist of two irregular concavo-convex tubers, between which a smaller rounded or flattened third tuber is found; all forms are hard and horny, inodorous and persistently bitter.—**C.** Four alkaloids, an acrid resin, bitter extractive, etc. The Eclectic preparation *Corydalin* is an impure mixture of alkaloids and resins.—**U.** Tonic, diuretic and alterative. Dose: 1 to 2 grams.

Salep

N. Salep.—**O.** The prepared tubers of *Orchis mascula, O. militaris, O. morio,* and other determined and undetermined varieties of *Orchis; Orchidaceæ,* sub-order *Ophrydeæ*.—**H.** Germany and France.—**D.** Irregularly oval, globular or flattened roundish tubers; sometimes deeply wrinkled or shrunken; about 2 cm. long; hard, heavy, yellowish or yellowish-gray, translucent; fracture homogeneous, horny, shining; inodorous; taste insipid mucilaginous.—**C.** Bassorin, starch, etc.—**U.** Nutritive and demulcent. A mucilage made from salep is occasionally employed as a vehicle for acrid or irritating remedies.

The tubers of salep are of gelatinous fleshy consistency when fresh and contain starch grains. They are prepared for trade by

scalding in boiling water and then rapidly drying in ovens; the starch is swelled and altered to a paste in the cells and to this is due the horny appearance of the drug.

A larger and darker-colored variety than that above described was formerly brought from Oriental countries.

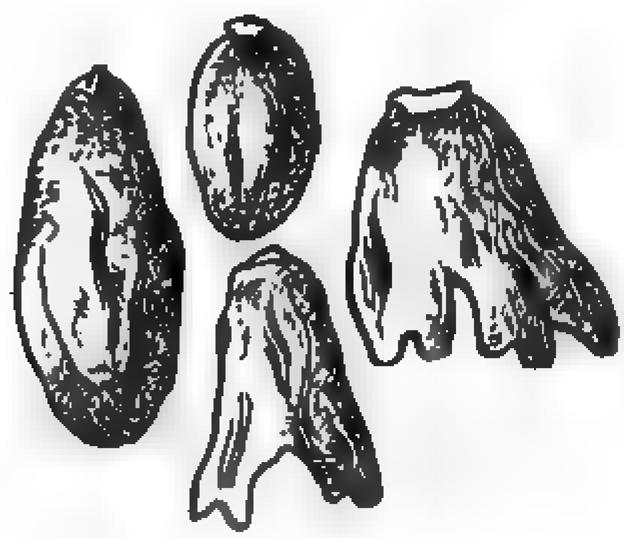


Fig. 201.

A variety which is palmately lobed is obtained from *O. latifolia, O. maculata,* etc., and was formerly gathered separately and sold as *Radix palmæ Christi*. Tubers of this kind are sometimes, although rarely, found mixed with the ordinary trade variety described above.

One part of powdered salep boiled with forty parts of water forms a thick jelly on cooling. The powdered salep should be thinly spread over the surface of the boiling water from the end of a spatula, otherwise it will lump and prevent the making of a perfect infusion.

GROUP XXXI

Sliced Corms

Kidney-shaped grayish-white slices............................Colchicum.
Transverse slices with dark-gray epidermis and mealy-white surfaces ....Arum.

Colchici Cormus

N. Commonly, though erroneously, called Colchicum Root.—**O.** The tuber of *Colchicum autumnale; Liliaceæ.*—**H.** Europe.—**D.** The whole tuber is rarely found in the drug trade. The whole corm

is about 3 cm. high, ovoid, with a groove on one side in which, in the fresh state, the lateral bud rests, which forms the next season's corm. But usually the drug consists of the corm cut into slices and then dried; these slices are generally transverse, but longitudinal slices also occur. The transverse slices are kidney-shaped, about 25 mm. in the longest diameter and about 2 mm. thick; one surface of the upper and under slices and the edges of the intermediate slices are covered with a brownish epidermis, while the cut surfaces are grayish or grayish-white and speckled with slightly darker dots

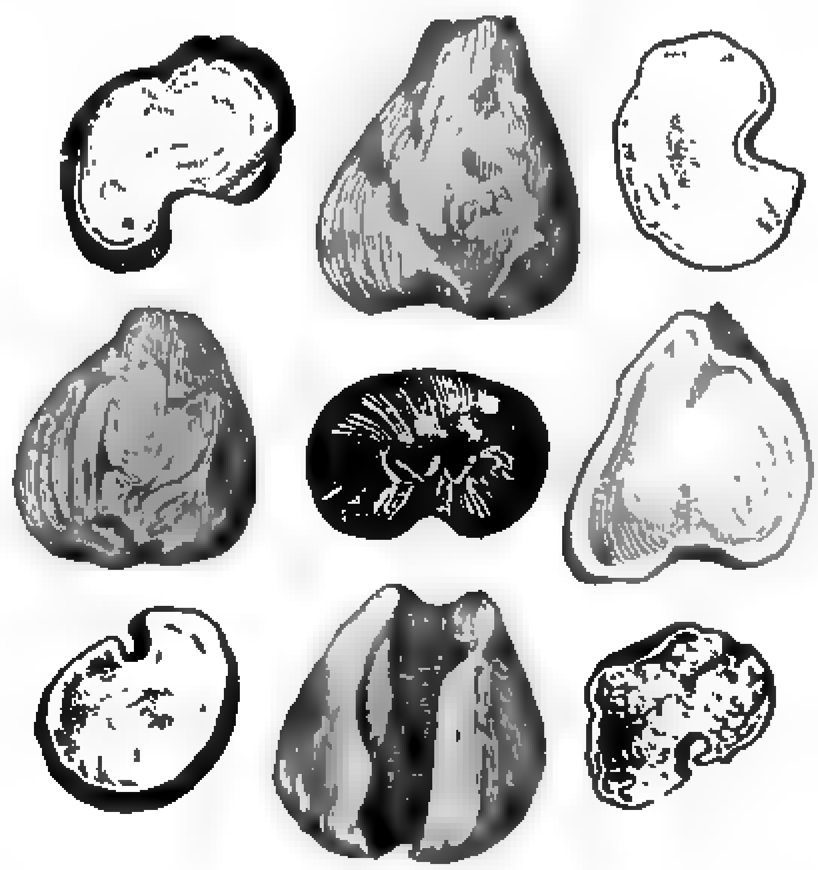


Fig. 202.

(the sections of fibro-vascular bundles, endogenous arrangement): breaks with abrupt mealy fracture; inodorous and with sweetish-bitter and somewhat acrid taste.—C. Colchicine, alkaloid, of which the drug should yield not less than 0.35 per cent.—U. Cathartic and diuretic, mainly used as antarthritic in gout and rheumatism. Dose: 0.1 to 0.5 grams.

Colchicum corm which is dark-colored or horny should be rejected. In the illustration the central figure is an upper transverse slice, the four corner figures are of inner transverse slices, the upper middle and left-hand middle figures show longitudinal outer

slices and incidentally give an idea of the appearance of the whole corms, while the middle figure in the lower row shows the groove in a longitudinal slice; the right-hand middle figure is an inner longitudinal slice; all natural size.

Colchicum is very subject to injury by insects, and should be well preserved and often inspected to protect it.

Arum

N. Indian Turnip.—**O.** The tubers or corms of ***Arum triphyllum (Arisæma triphyllum); Araceæ.***—**H.** North America.—**D.** Occurs in transverse slices, from 2 to 5 cm. in diameter and 3 to 6 mm. thick;

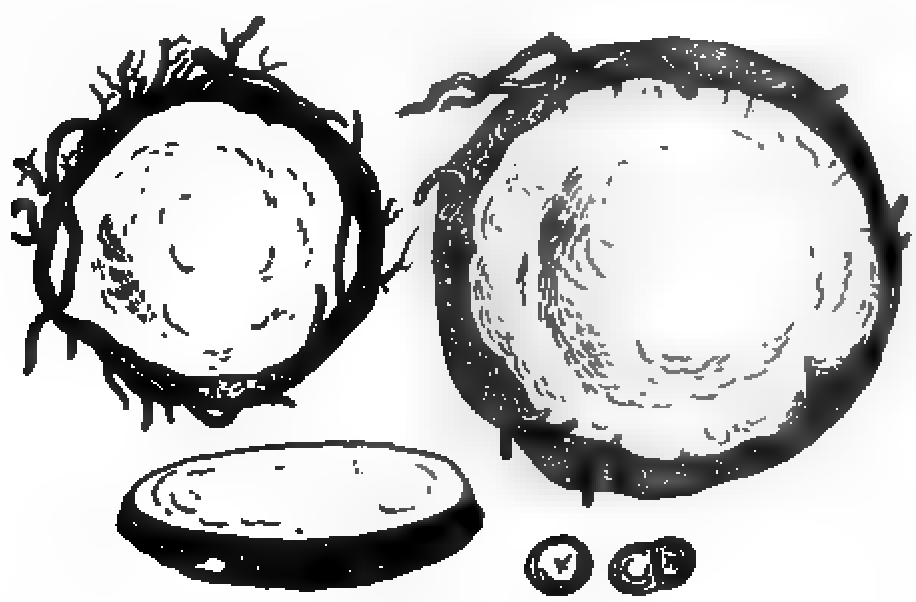


Fig. 203.

the outer edge covered with epidermis is dark gray and beset with rootlets; the cut surfaces are white; the drug breaks with an abrupt mealy fracture; no odor; taste acrid.—**C.** A volatile acrid principle, which is exceedingly pungent in the fresh corm, but gradually is lost on keeping, until the drug becomes almost or entirely inert.—**U.** Stimulant, expectorant, diaphoretic and carminative. Dose: 1 to 2 grams three or four times daily.

The illustration shows three slices, natural size, and a few starch grains, enlarged.

European Arum, from *Arum maculatum*, is similar to the American drug.

BULBS

A bulb is a form of stem resembling the corm as to its solid part, but the bulk of it consists of thick or fleshy leaf-scales surrounding the buds which are found at the apex of growth within. These leafy envelopes may be narrow and arranged like shingles on a roof, overlapping each other (scaly bulb) or they are wide and each one is wrapped more or less nearly completely around all the others within (tunicated or coated bulb); the latter arrangement is seen in the onion, and it is the arrangement found in all medicinal bulbs.

Bulbs may be grouped, for purposes of pharmacognosy, as whole bulbs and as sliced bulbs.

BULBS	Whole	32
	Sliced	33

GROUP XXXII

Whole Bulbs

Only one bulb always comes into trade whole—Garlic. The most important bulb from a medicinal point of view is Squill, and this can sometimes be had fresh and whole, especially from florists for cultivation as a pot-plant, but in the drug trade this drug usually comes sliced and dried, and therefore belongs in the next group. The onion is sometimes mentioned in works of pharmacognosy, but is seldom used medicinally.

Large, juicy, greenish or pinkish-white bulbs, the external scales, when present, pinkish-brown .... **Scilla.**
White bulbs, with stem, coated with a few dry, membranous, white scales enclosing about eight bulblets .... **Allium.**

Scilla

In some pharmacopoeias the fresh bulb is demanded as the drug. It is a large, pear-shaped, tunicated bulb, resembling a large onion in appearance, but without the odor; up to 15 cm. long and 10 to 15 cm. broad; the external scales are pinkish-brown, the inner scales are greenish or pinkish-white, juicy and translucent. The whole bulb is rarely found in the drug trade in our country and the reader will find this drug described in the next group.

Allium

N. Garlic.—**O.** The fresh bulb of *Allium sativum; Liliaceæ.*—**H.** Cultivated everywhere.—**D.** The illustration shows the bulb in natural size, except that the stems are usually 10 to 15 cm. long so that the bulbs can be tied in bundles and hung up in a dry, cool place, in which manner they can be kept fresh through the year. The middle figure shows the stem with its dry corm-like disk and with one of its bulblets attached. On this disk there are about eight

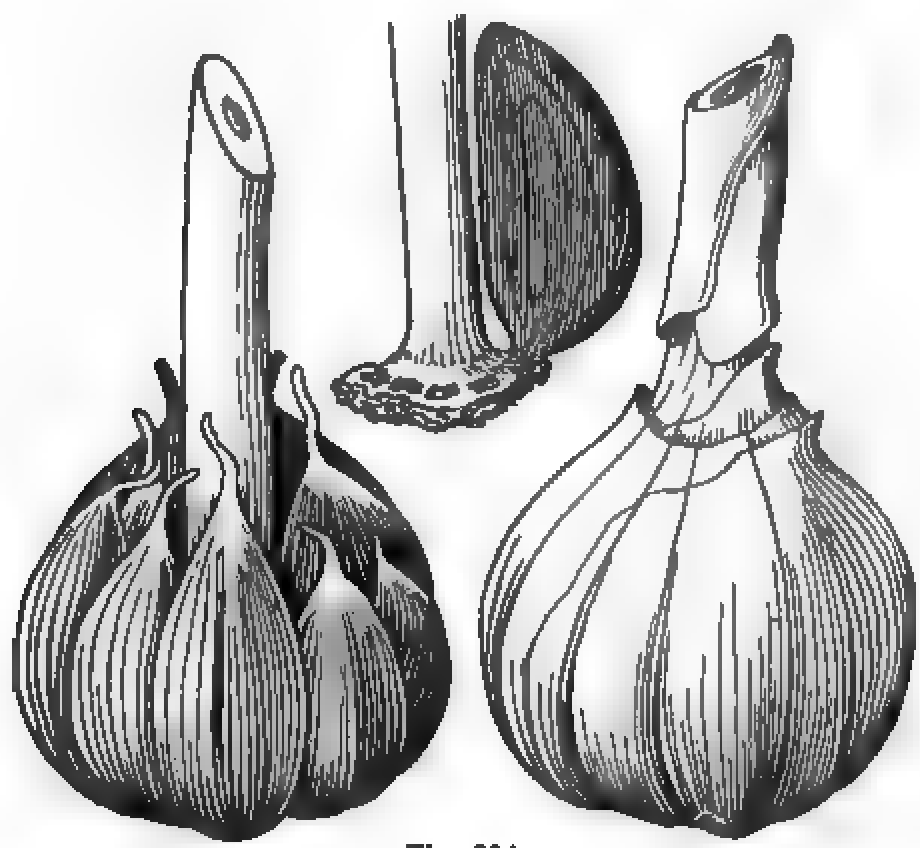


Fig. 204.

bulblets (called "cloves of garlic"), arranged as in the left-hand figure, and surrounded with a few membranous scales which extend around the stem above. When wanted for use the scales and stem are rejected and only the "cloves" are used. Garlic has a peculiarly pungent, penetrating and persistent odor, resembling asafetida, and a pungent acrid taste.—**C.** Volatile oil.—**U.** Blennorrhetic, carminative and stomachic; wholesome and appetizing and used as an ingredient in most table sauces. Used in larger quantities it is objectionable on account of the odor it imparts to the breath and the flatulence it produces. Dose: About 2 grams.

GROUP XXXIII

Sliced Bulbs

Scilla

N. Squill.—**O.** The bulb of *Scilla maritima (Urginea maritima); Liliaceæ.*—**H.** Mediterranean countries.—**D.** After the outer partially dry and brownish scales have been removed the bulb is sliced in the same manner as onions are sliced for culinary purposes. The small inner scales are rejected and the intermediate scales are separated and dried; these latter then constitute the drug. Narrow slices up to 5 cm. long, 10 to 15 mm. broad and about 3 mm. thick in the thickest part; often contorted or broken; whitish with a yellowish or pinkish tint; slightly diaphanous; brittle and pulverizable when dry, but often somewhat flexible and horny on account of its hygroscopic character which causes it to

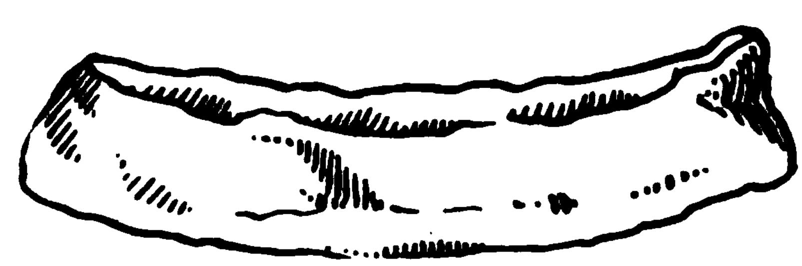


Fig. 205.

absorb water with great avidity; if exposed to moisture it becomes darker-colored and less valuable; no odor; taste mucilaginous, bitter and acrid.—**C.** Scillipicrin, scillitoxin and scillin.—**U.** In small doses, diuretic and expectorant; in large doses, emetic and cathartic. Dose: 0.05 to 0.1 gram as an expectorant; up to 0.5 gram as an emetic; best given in syrup or fluid extract.

TWIGS OR BRANCHES.

Twigs or branches are parts of the ascending axes of plants, and therefore have the structure of stems, that is, they have nodes and internodes and if leaves are not present they show leaf-scars or occasionally leaf-scars with undeveloped leaf-buds. All the medicinal twigs are from exogenous woody plants and therefore show the characteristic structure of that class of stems.

Some drugs consist of twigs with leaves attached; these leaves

may be ordinary foliage leaves, or the peculiar scaly leaves of some conifers. Some twigs come into trade without any leaves attached. These twigs are not always the drugs as recognized by the pharmacopoeias or other authoritative works, but may be simply gathered as twigs, when in reality only the leaves are wanted. Leafy twigs should not be confounded with the drugs of Group IX, flowering tops, which are mostly herbaceous branches with flowers, or with both leaves and flowers. The narcotic herbs as found in bales usually are the smaller branches with leaves and sometimes flowers, although these drugs are officially described as the "leaves" of the respective plants.

GROUP XXXIV.

Leafy Twigs.

Many of the drugs used as "flowering tops" or as "leaves" may be mistaken for leafy branches; such drugs must be remembered and if a drug taken to be a leafy branch is not found mentioned here, it may be looked for under Group IX, or under Groups XLVII, XLVIII, XLIX or L. A few drugs consisting wholly or mainly of inflorescences, as cusso, may also be mistaken for leafy twigs; such would be found mentioned under Group LI. Sometimes an inferior Cannabis Indica, consisting mainly of stems, might be looked for here.

Twigs with obovate or oval, coriaceous, slightly serrate leaves .... **Gaultheria.**
Twigs mixed with coriaceous, oblanceolate or cuneate-lanceolate leaves, with margin serrate at apex and entire near the base .... **Chimaphila.**
Twigs and leaves agglutinated into broken masses with exuded gum-resin; leaves lanceolate, dentate.......... **Eriodyction.**
Brownish-green twigs with oval, thick coriaceous, and deeply wrinkled leaves; leaves usually detached from twigs.... **Phoradendron.**
Twigs with scythe-shaped, long, light-grayish-green leaves.. **Eucalyptus.**

Gaultheria.

N. Gaultheria, Wintergreen.—**O.** The leaves of *Gaultheria procumbens; Ericaceæ.* Only the leaves should be used, but the drug, as it comes into trade, always consists of the twigs with the leaves. —**H.** North America, from far north southward to Georgia and

westward to Minnesota.—**D.** The illustration gives a good idea of the appearance of the drug, natural size; the twigs are slender, flexible, and much tangled in the drug, and unless packed tightly in the bale the upper part of the bale is apt to contain mainly twigs and the lower part most of the leaves; the leaves are

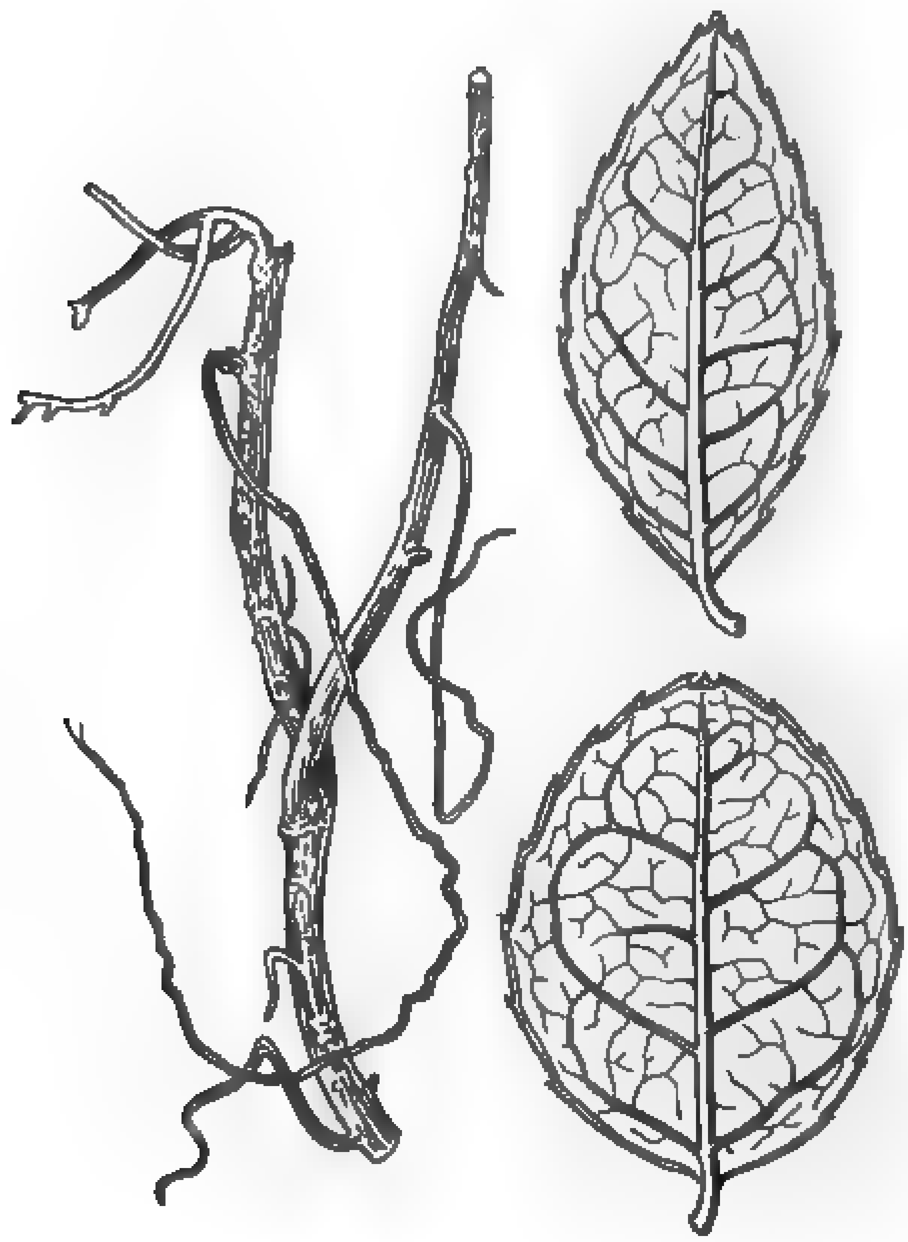


Fig. 206.

obovate or oval, short-petiolate, obscurely serrate with teeth hard, sharp and appressed, coriaceous or leathery, smooth and glossy, varying in color from green to brown; odor fragrant and taste pleasantly aromatic.—**C.** Volatile oil, methyl salicylate, tannin, etc.—**U.** Stimulant and slightly astringent. Dose; 2 to 5 grams, in infusion or fluid extract.

Chimaphila.

N. Chimaphila, Pipsissewa, Prince's Pine.—**O.** Leaves of *Chimaphila umbellata; Ericaceæ.* The leaves alone should be used, but twigs are always admixed.—**H.** North America, Nova Scotia to

Fig. 207.

Georgia, west to the Pacific.—**D.** The illustration gives a good idea of the drug, natural size; the leaves are cuneate-lanceolate, or oblanceolate, with margin serrate at apex and entire near the base, coriaceous, smooth, dark-green to brown, with little odor and a bitterish, slightly astringent taste.—**C.** Chimaphilin, arbutin, a small proportion of tannic acid, etc.—**U.** Alterative, astringent

and tonic. Dose: 1 to 5 grams or more, in infusion or in fluid extract.

The two drugs just described, Gaultheria and Chimaphila, are a good illustration of the necessity of using Latin scientific instead of common English or vernacular names. Both of them are called "Wintergreen," so that much confusion arises from the application of this same name to two different drugs; and in my own experience these particular two drugs caused me more trouble in this regard than all other drugs put together, before I finally learned to call only Gaultheria by the name of Wintergreen. In the text, therefore, Wintergreen is not given as one of the English names of Chimaphila, and throughout this book care is taken to apply an English name only to the one drug to which it is most commonly applied, even when the same name is used for several drugs.

Eriodyction.

N. Eriodyction, Yerba Santa.—**O.** Leaves of ***Eriodictyon Cali-***

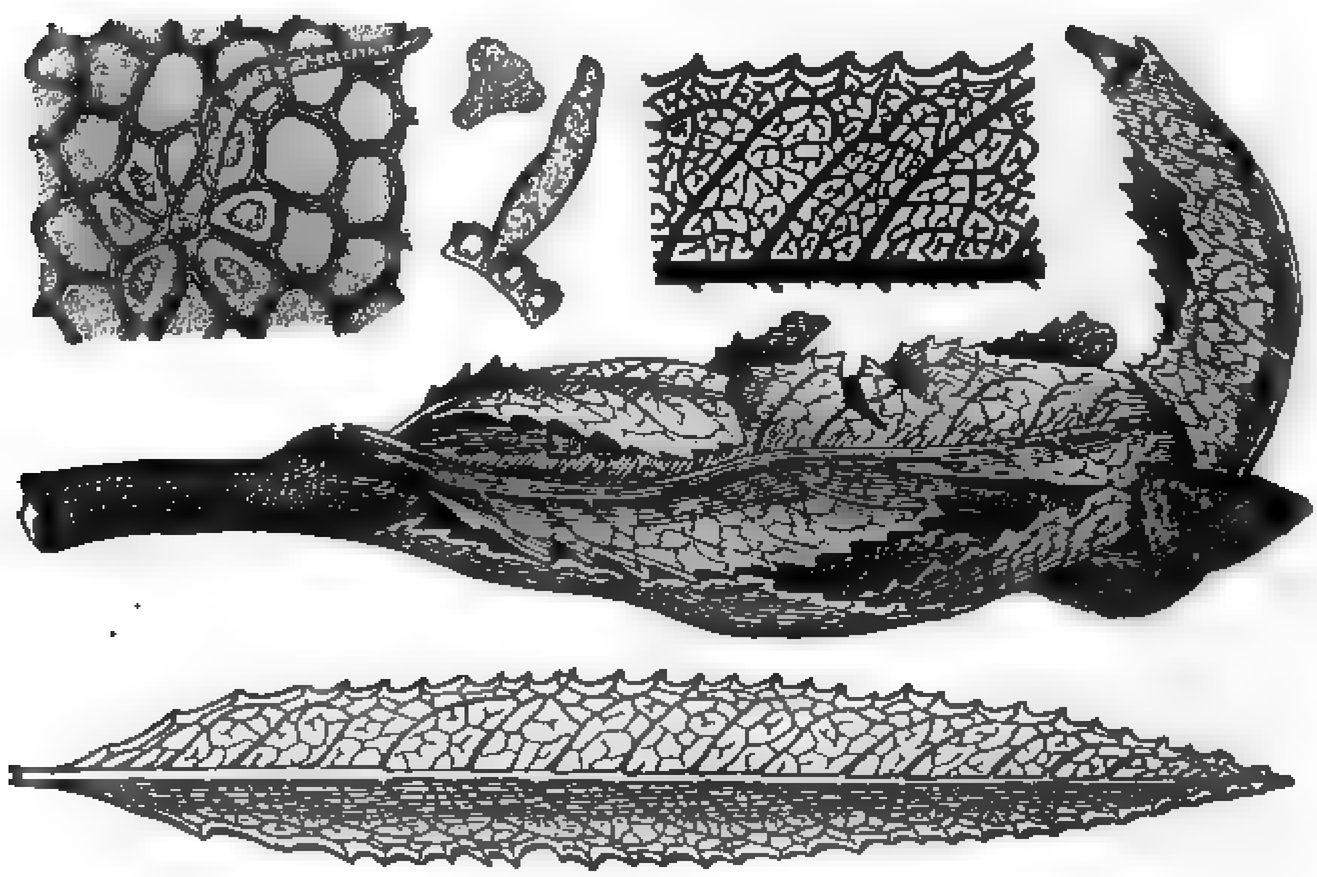


Fig. 208.

fornicum (Eriodictyon glutinosum); Hydrophyllaceæ. The leaves are always mixed with the twigs.—**H.** California.—**D.** The illus-

tration shows a specimen of the drug in natural size, showing the manner in which leaves and twigs are agglutinated, and also one leaf whole in natural size; frequently, however, the leaves are smaller, more broken and agglutinated into almost formless masses, or broken into small fragments. The small drawings show the venation on the lower surface of a leaf, after having removed the resin by soaking in warm soda lye, then washing and drying; also a portion of epidermis with plain hair and a glandular hair. The leaves are lanceolate or oblong-lanceolate, acute, irregularly dentate, upper surface smooth, grayish-green or brownish and glossy from resin, lower surface grayish, netted-veined and hairy; odor fragrant; taste aromatic, sweetish.—**C.** Acrid resin and small quantity of volatile oil, etc.—**U.** Stimulant blennorrhetic and expectorant. Dose: 1 to 2 grams.

Yerba Santa is largely used, in combination with other drugs, in the manufacture of vehicles to disguise the bitterness of quinine, etc.

Phoradendron.

N. Phoradendron, American Mistletoe.—**O.** The whole parasitic plant, *Phoradendron flavescens; Loranthaceæ.*—**H.** United States,

Fig. 209

from New Jersey to Missouri and Southwest.—**D.** See the illustration. The drug consists of various-sized, much-branched frag-

ments of twigs of a yellowish-green or brownish-green color, deeply wrinkled longitudinally, and showing section as illustrated; the leaves are of the same color as the twigs, thickly coriaceous and deeply and irregularly wrinkled, and often broken from the twigs; the odor is heavy, disagreeable and the taste is bitter and somewhat astringent.—**C.** A tenacious substance called "viscin" (bird-lime), resin, fixed oil, tannin, etc.—**U.** Has been recommended as a parturient; also as an astringent in uterine hemorrhage. Dose 1 to 5 grams, best as fluid extract.

The European drug, the twigs and leaves of *Viscum album,* closely resembles the American Mistletoe.

Eucalyptus.

Eucalyptus is usually a mixture of twigs, scythe-shaped leaves and buds as it comes in the bales, but it is generally garbled before it is sold to the retail drug trade so that it then consists of leaves alone. It is mentioned here, but will be described fully under Group XLVII.

GROUP XXXV.

Scaly Twigs.

Scaly twigs are obtained from several evergreen conifers; they resemble each other rather closely and consist of twigs, with four rows of scales (scaly leaves) which are closely appressed to the twigs. Examine scales with a lens.

Scales with a longitudinal ridge and projecting gland.............. **Thuja.**
Scales with a longitudinal groove.............................. **Sabina.**

Thuja.

N. Thuja, Arbor Vitæ.—**O.** The fresh terminal twigs of *Thuja occidentalis; Coniferæ.*—**H.** Canada and Northern United States; frequently cultivated as an ornamental evergreen shrub.—**D.** Much-branched, flattish two-edged twigs with scaly leaves appressed in four rows, broadly ovate, bluntly pointed, those on the flat sides opened flat, those on the edges doubled or folded, the flat ones with an elevated ridge and a raised and rounded oil or balsam-gland; the illustration shows two twigs enlarged, and

a few of the scales enlarged about 5 diameters; odor balsamic and taste pungent, camphoraceous and bitter.—**C.** Volatile oil, resin, etc.—**U.** Alterative, blennorrhetic; externally as a stimu-

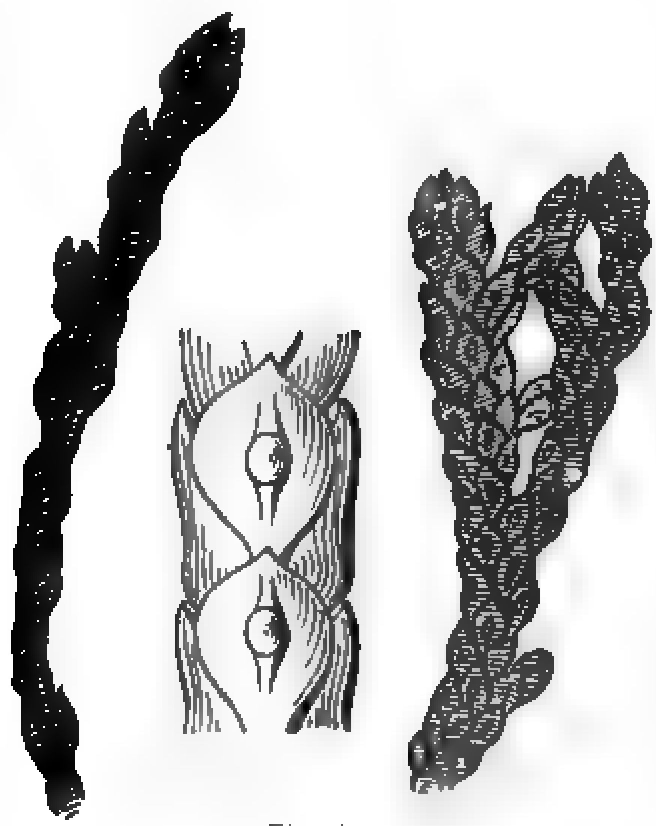


Fig. 210.

lant to indolent ulcers. Dose: 2 to 5 grams, three or four times a day; best in fluid extract. Much used as an ingredient of cough medicines.

Sabina.

N. Savin.—**O.** The terminal twigs of *Juniperus Sabina; Coniferæ*. The twigs should be collected in spring.—**H.** Northern Asia,

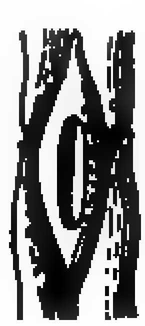


Fig. 211.

Fig. 212

Europe and America.—**D.** Branched, rounded or sub-quadrangular twigs with four rows of scaly leaves, imbricate, lanceolate and acute; scales about 2 mm. long, with a longitudinal groove or

depression on the outer surface, or back; the color of a fresh drug should be greenish, not brown; the odor is terebinthinate and the taste disagreeably bitterish and acrid. The drawing shows the scales magnified five diameters. (See Fig. 211.)—**C.** Volatile oil, resin, tannin, etc.—**U.** Irritant diuretic, emmenagogue and vermifuge. It is sometimes administered in large doses to produce abortion, and then often leads to dangerous or fatal gastro-intestinal inflammation. A dose sufficiently large to produce abortion is also very apt to produce death. Dose: 0.3 to 1 gram.

Terminal twigs of common juniper, ***Juniperus communis,*** are said to be sometimes substituted for those of ***Juniperus Sabina;*** the general appearance is similar, but the scaly leaves are less pointed, even obtuse, and on the back is a groove, at the bottom and lower end of which is a gland, as seen in the accompanying drawing, (Fig. 212). This represents the leaves of common juniper magnified five diameters.

GROUP XXXVI.

NAKED OR LEAFLESS TWIGS.

Only one drug consisting of naked twigs is commonly to be found in the drug-market—Dulcamara. The fresh, or recently dried, flowering twigs or branches of Night-Blooming Cereus must be obtained from florists, etc., as they are not an article of commerce. Broom, which should be the flowering tops, consists occasionally of slender naked twigs, which are in reality the axes of inflorescences from which the flowers have been broken.

Short, pale, grayish-green pieces of twigs, with smooth-cut ends; usually hollow .... **Dulcamara.**

Pale-green, five or six-angled stems, with clusters of spines on the edges .... **Cereus.**

Dulcamara

N. Bitter-sweet.—**O.** The first, second and third year's twigs of *Solanum Dulcamara; Solanaceæ.*—**H.** Europe and North America. —**D.** The twigs are chopped into lengths of about three to five

centimeters, and are 1 centimeter or less in thickness, the average thickness being about five or six millimeters; the pieces are cylindrical, somewhat angular from deep longitudinal wrinkles or grooves due to drying, marked with alternate leaf-scars and small buds, and the pith is generally torn and shrunken so that many of the pieces appear to be hollow; the external bark is light greenish-gray, the middle and inner bark is green in fresh and yellowish in old drug, and the wood is yellowish or greenish-gray; according to the age of the twig when gathered; it has one or two (rarely three) annual rings, the wood being radiate with many fine medullary rays and containing large ducts; the odor is faint, the taste is at first bitter, then sweetish.—**C.** A glucoside,

Fig. 213.

dulcamarin, and an amorphous bitter substance from which the alkaloid solanin has been isolated.—**U.** Alterative, especially useful in non-syphilitic scaly skin diseases; in large doses anodyne and narcotic. Dose: 2 to 5 grams, best in fluid extract.

Cereus Grandiflorus.

N. Night-Blooming Cereus. The preparations of this drug are commonly called for under the name "Cactus Grandiflorus".—**O.** The fresh stems and flowers of *Cereus grandiflorus; Cactaceæ.*—**H.** Tropical America; cultivated.—**D.** This drug cannot readily be obtained in the drug trade, as the fresh stem is wanted. Occasionally, however, the dried stems may be bought. The genuine drug

consists of branches of various lengths, about $1\frac{1}{2}$ to 2 cm. thick, five to seven-angled, the edges beset with radiating clusters of 6 to 8 short spines, and at irregular distances apart there are branched rootlets; the wood is thin and the bark consists of spongy parenchyma; odor none, taste acrid.—**C.** An alkaloid (?) cactine.—**U.** Diuretic, in dropsies, but mainly valued as a cardiac stimulant. Dose: about 0.5 gram, in tincture.

Fresh Cereus Grandiflorus Stems.—As the fresh stems should be used, it is best to obtain them from florists, who sometimes have more than they require for their business; in this way, however,

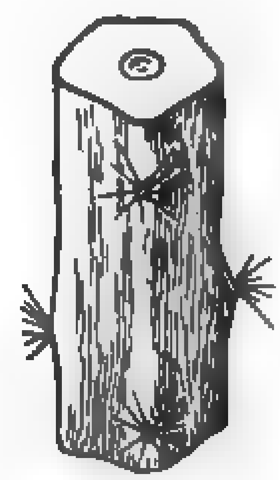


Fig. 214.

only small quantities are obtainable. Manufacturers of pharmaceuticals frequently obtain the drug from Mexico, or the West Indies, the flowers and branches being crushed and packed in barrels and covered with a definite proportion of alcohol, so that it is a simple matter afterwards to add the menstruum necessary to make the commercial tincture.

It is more than probable that much of the tincture sold is made from other and inferior or even worthless varieties of cactus.

PARTS OF BRANCHES.

As already explained in previous pages, the exogenous stem consists of three parts, an internal portion of soft-walled and usually polyhedral cells which is called the medulla or pith, the wood, consisting of the *xylem* of the fibro-vascular bundles and the

medullary rays, and lastly, the bark, which is all that part which lies outside of the cambium. Some drugs consist of pith alone, some only of wood, and many are barks; each of these parts of branches or stems must therefore be separately considered.

GROUP XXXVII.

PITHS.

There is only one pith which is a drug, namely, the pith of sassafras, but the pith of elder is sometimes kept in drug stores, and probably always in stores dealing in scientific instruments; it is also commonly used by microscopists for holding delicate tissues in the microtome, for section-cutting. Both piths are therefore apt to be met with by the student of pharmacognosy.

Slender cylindrical, sometimes curved pieces, spongy, white .... **Sassafras Medulla.**
Similar to above, but thicker and yellowish in color.... **Sambuci Medulla.**

Sassafras Medulla.

N. Sassafras Pith.—**O.** The pith of *Sassafras variifolium; Lauraceæ*.—**H.** North America.—**D.** Slender, cylindrical or semi-cylindrical pieces, often curved or twisted, very light and spongy; two to three centimeters long and about 4 to 6 mm. thick; consists of thin-walled polyhedral cells; without odor and with insipid taste. —**C.** Mucilage.—**U.** When macerated with water it forms a mucilage which is not precipitated by alcohol. This mucilage is used as a menstruum or vehicle for other substances, especially for eye washes.

Sambuci Medulla.

Elder pith (from *Sambucus Canadensis; Caprifoliaceæ)* is in larger and thicker pieces than sassafras pith, and is of a yellowish color. It is composed of similar polyhedral cells, but is not mucilaginous. Used only for physical experiments, and for holding delicate objects for cutting sections for the microscope, as already mentioned.

WOODS.

Strictly speaking, wood is that tissue in plants which is made up of lignified cells, but it is generally considered to be all that part of exogenous stems which is within the cambium layer. Commercially, at least, this is the meaning of "wood" in the drug trade as well as in the lumber trade. By reference to the description of the section of an exogenous stem the relation of the fibro-vascular bundles to each other and to the other structures in the stem will be understood. (See page 274.) In the accompanying drawing the structure of the wood-cylinder is represented somewhat diagrammatically. In the interior is seen the pith, which is very small

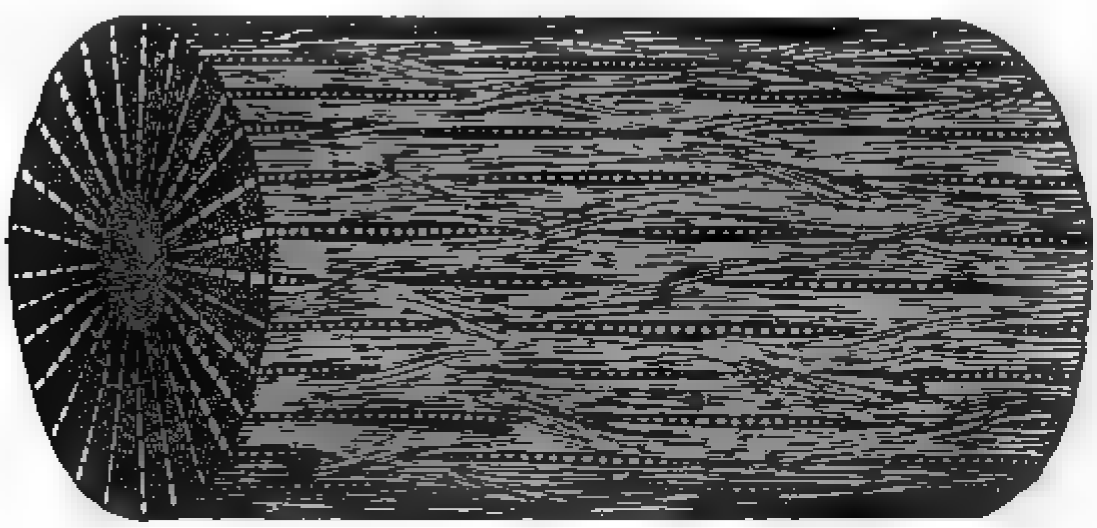


Fig. 215.

proportionately in logs from which "wood" is obtained; from this pith the medullary rays radiate showing as radiating lines on the transverse section, but on the outside of the wood-cylinder these medullary rays form only short perpendicular lines, as they are not extended far in a perpendicular direction; this is also the appearance of the medullary rays in tangential sections. Medullary rays vary in width, in some cases being only a single cell wide, in other woods being two, three or more cells wide; this character of the medullary rays is of diagnostic value in some woods, notably so in quassia.

As the stem grows, the cambium and bark and a few rings of wood next to the cambium are the living tissues; the inner portion of the stem ceases to take part in active vegetative processes and

merely serves for mechanical support. The outer layers of wood, which are filled with protoplasm and cell-sap and take part in the vegetative life of the tree, are usually white and constitute the *alburnum* or *sap-wood,* which is of little value, either as lumber or as drugs. As layer after layer of wood is added year after year, the inner layers are correspondingly withdrawn from the vegetative processes of the plant by an absorption of protoplasm and cell-sap and a deposit of extractive, resinous and coloring matters, etc., in the place of the protoplasm, and these inner layers of wood then constitute the *duramen* or *heart-wood.* The heart-wood may be of the same color as the sap-wood, but often differs in color; in red cedar, for instance, the outer wood is white and the heart-wood is red; in walnut the heart-wood is brown; in guaiac wood the heart-wood is dark olive-green or greenish-brown; in ebony the heart-wood is black; etc. The formed materials stored in the cells of the heart-wood render many woods valuable, either because these substances have medicinal virtues or because they can be used for dyeing; in either case, woods containing them become valuable as drugs.

The stems of the trees of the temperate zone, where there is complete cessation of growth during winter, are marked with perfect concentric annual rings; stems of trees of tropical climes, where growth is not thus completely suspended for a season, but goes on all the year, have no such rings, although they may be marked with "spurious" rings, as seen, for instance, in the section of a false pareira brava, shown on page 171. With the exception of juniper wood, which is, however, rarely used, all the woods of the drug trade are from tropical trees and have obscure rings; this, however, is of little importance, as all the woods sold as drugs are sold as shavings or raspings, and it is impossible, therefore, to determine this feature in the fragments that constitute the drugs.

Woods may show a uniform structure of wood-cells under the microscope, the cells varying in size, but otherwise alike, and traversed at more or less regular intervals by the medullary rays; such woods are close-grained and even on section. Other woods have large ducts interspersed among the wood-cells, and such woods are more porous and show large openings on transverse section when

examined with a lens; the peculiar grouping of these ducts sometimes aids in the recognition of the wood.

But the most easily observed, and at the same time sufficiently characteristic feature of woods for recognition, is color, and we group woods as follows:

WOODS....	White	38
	Colored	39

GROUP XXXVIII

WHITE WOODS

Only one white wood, quassia, is of importance. Some authors mention *Santalum album* as a white wood, but it is merely the sapwood of the same plant from which *Santalum citrinum* is obtained and is seldom met with, and is worthless.

Coarse, light, white shavings or raspings........................**Quassia**

Quassia

N. Quassia.—**O.** The wood of *Picrasma excelsa; Simarubiaceæ.*—**H.** Jamaica, West Indies.—**D.** Quassia wood is imported in billets of various sizes, dense and tough, of medium hardness, porous, with minute pith and narrow medullary rays; in the drug trade, however, it occurs as coarse, light, white shavings or raspings, odorless and intensely bitter.—**C.** A bitter principal called quassin. It contains no tannin and the infusion is therefore compatible with iron salts.—**U.** A pure bitter tonic. Dose: 2 to 5 grams, in infusion.

The quassia used in Europe is the wood of ***Quassia amara,*** of the same natural order as the plant which yields the drug used in this country. The wood of Quassia amara is called in the trade "Surinam Quassia," the shrub from which it is obtained being indigenous to Surinam. It resembles the Jamaica quassia which is used in this country, especially when in the form of shavings.

The illustrations show Jamaica quassia in transverse (**Fig. 216**) and tangential (Fig. 217) sections; it will be noticed that the medullary rays vary from one row of cells to two or three rows

of cells in width. In Surinam quassia the medullary rays are rarely wider than one row of cells. This enables us to distinguish

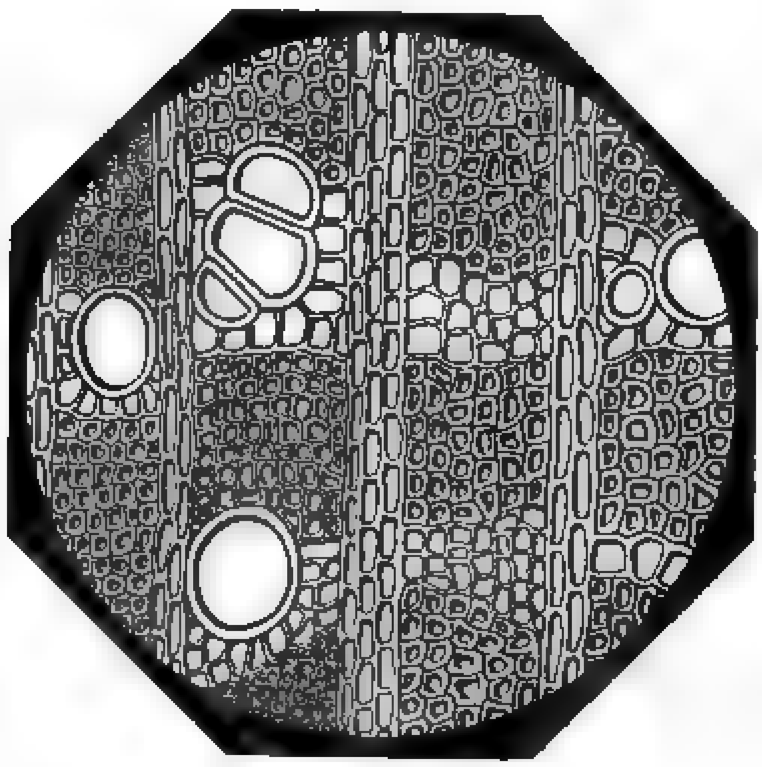


Fig. 216.

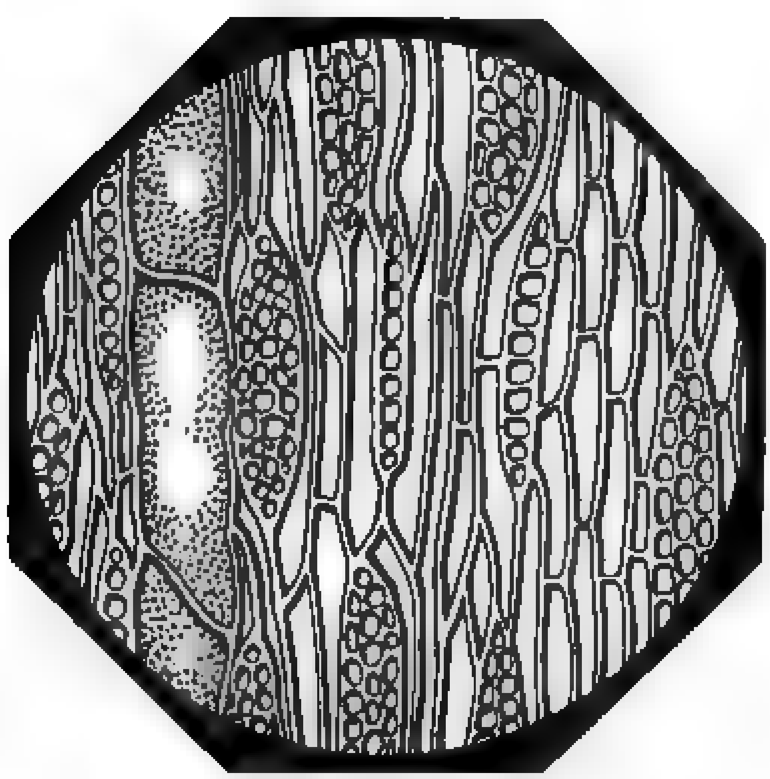


Fig. 217.

between the two kinds, although from a practical point of view there is no object in doing so, as the medicinal value of the two kinds of quassia is alike.

Sandal Wood (the wood of *Santalum album, Santalaceæ),* is imported, but does not reach the retailer, as it is only used for the preparation of volatile oil. Only the sap-wood is white and this is worthless, as it contains no oil. The heart-wood varies in color from yellowish to brown, and is described by some authors as *Santalum citrinum.*

GROUP XXXIX

Colored Woods

Some of the darker colored woods, like guaiac wood, contain but little soluble coloring matter, so that their solutions will not deeply stain fabrics moistened with them. Others, like logwood, contain an abundance of coloring matter, so that they can be used as dye-stuffs; and, in fact, many of the woods which are used as drugs have no medicinal value, their whole commercial importance depending on their being dye-stuffs. Before the introduction of the aniline dyes it was necessary for the pharmacist not only to be acquainted with these dye-woods, but also with the manner of using them, with the mordants to be used, etc.; now they are seldom called for in drug stores, although still extensively employed by dyers.

Greenish-brown raspings, mixed with some white particles	**Guaiaci Lignum.**
Yellowish or reddish-gray raspings	**Juniperi Lignum.**
Deep purplish-red or brownish-red shavings, or coarse powder	**Santalum Rubrum.**
Red or reddish-brown raspings, the cut surfaces having resinous appearance	**Fernambuco.**
Purplish-black or brownish-red shavings or raspings, often with a greenish-metallic luster	**Hæmatoxylon.**
Brown or yellowish-brown chips or raspings	**Lignum Citrinum.**

Guaiaci Lignum

N. Guaiacum Wood, Lignum Vitæ.—**O.** The heart-wood of *Guaiacum officinale* and *G. sanctum; Zygophyllaceæ.*—**H.** West Indies.—**D.** This wood is imported in large logs or billets and is much used in the arts for the manufacture of articles which must stand much rough usage, as for instance ten-pins and balls for bowling. It is admirably adapted for such uses because the wood is firm

and the bundles interlace and cross each other often at angles of even 60°, so that it is practically impossible to split the wood "along the grain" in any direction. The wood is very hard, heavier than water, resinous, brown or brownish-green; the whitish sap-wood should be rejected. The drug consists of the raspings and shavings, which are the waste from the turners' benches; these raspings are greenish-brown, containing occasionally a

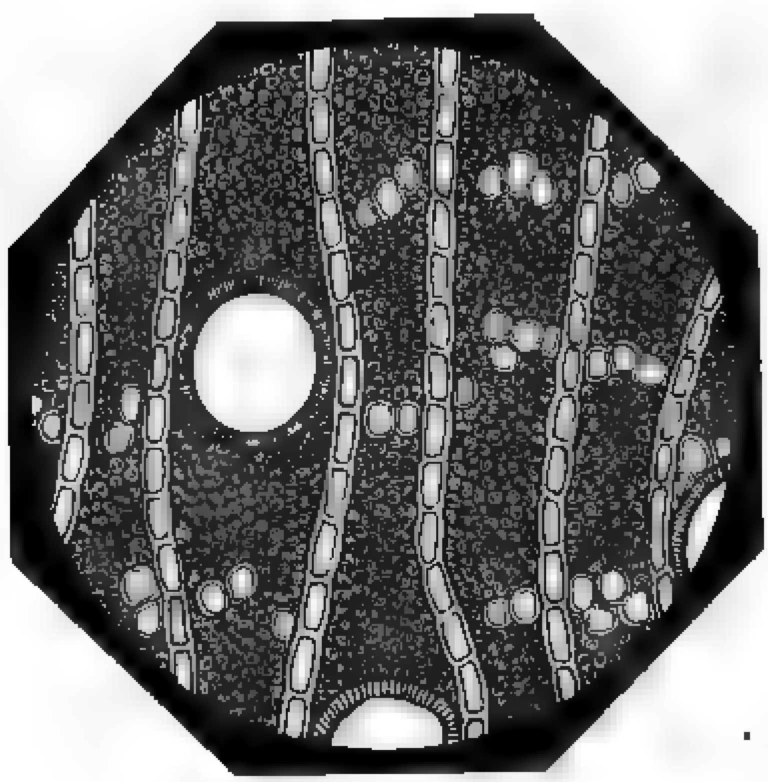


Fig. 218.

few fragments of the whitish sap-wood; on exposure to nitric acid fumes they become dark bluish-green; odorless unless heated, when the drug has a balsamic odor; the taste is slightly acrid.—**C.** Twenty to twenty-five per cent of resin.—**U.** Alterative diaphoretic. Dose: 2 to 5 grams in fluid extract.

The figure shows a transverse section of the wood.

Juniperi Lignum

N. Juniper Wood.—**O.** The wood of *Juniperus communis; Coniferæ.*—**H.** Northern Hemisphere.—**D.** The wood is distinctly marked with annual rings, the fall part of one and the spring portion of another being here shown in transverse section; all the cells are marked with pits, as in the pitted cells already described on page 85, and there are no ducts. The drug consists

of raspings of a reddish or yellowish-gray color; odor and taste similar to but weaker than juniper berries.—**C.** Volatile oil and resin.—**U.** Diuretic, stimulant and emmenagogue. Used only as an ingredient in alterative diuretic teas or species.

Fig. 219 shows a transverse section of the wood.

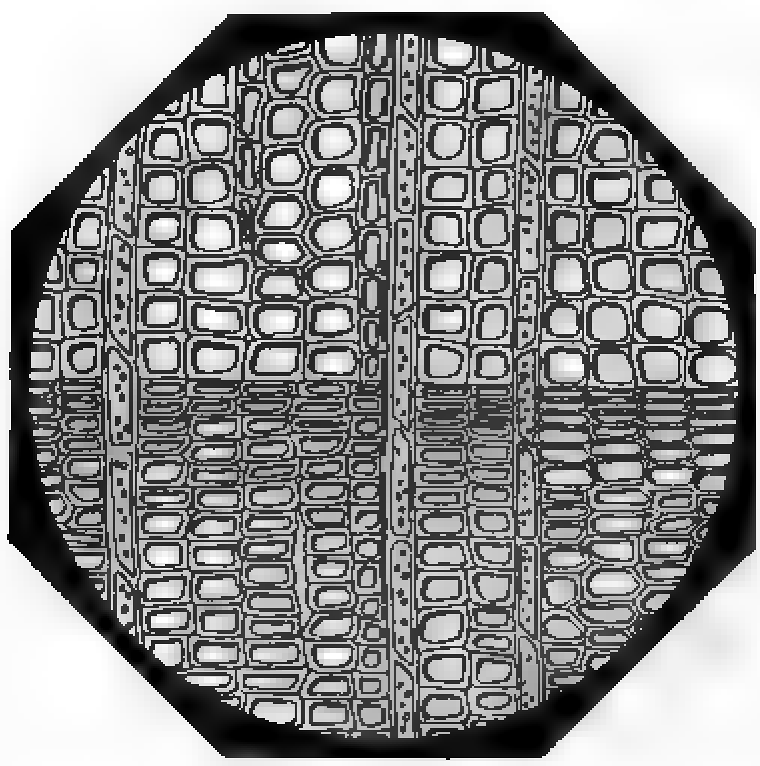


Fig. 219.

Santalum Rubrum

N. Red Saunders.—**O.** The wood of *Pterocarpus santalinus; Legauminosæ.*—**H.** East India.—**D.** The heart-wood is imported in hard, massive pieces, heavy (sinks in water), brownish-black externally and reddish-brown internally and susceptible of a fine polish. The drug consists of chips or, more frequently, of raspings in the form of a coarse, irregular, brownish-red powder; almost tasteless and odorless.—**C.** A coloring principle, santalin, which is soluble in alcohol but insoluble in water.—**U.** Employed as a coloring agent for elixirs, tinctures, etc.

Fernambuco

N. Brazil Wood, Pernambuco or Fernambuco Wood.—**O.** The heart-wood of several varieties of *Caesalpinia,* especially of *C. echinata; Leguminosæ.*—**H.** Brazil.—**D.** The heart-wood, without

the bark and sap-wood, is imported in large logs, externally dark reddish-brown, internally lighter in color; texture fine-grained; surfaces resinous; hard and susceptible of a fine polish. The drug consists of raspings, with a slightly sweetish taste, but scarcely any odor.—**C.** A coloring principle; brasilin, which is

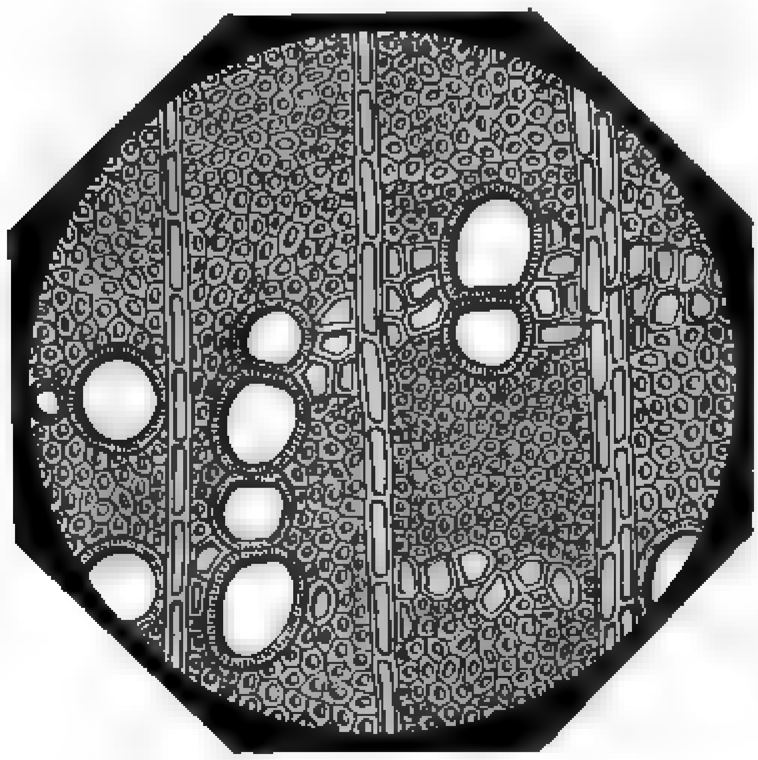


Fig. 220.

soluble in water, alcohol and ether, coloring them yellowish; by adding alkalies to its solutions, these assume a beautiful red color.—**U.** Fernambuco is sometimes used as a test-solution, but is mainly used as a red dye-stuff.

The figure shows a transverse section of the wood.

Hæmatoxylon

N. Logwood, Campeachy Wood.—**O.** The heart-wood of *Hæmatoxylon Campechianum; Leguminosæ.*—**H.** Campeachy, Honduras and other parts of tropical America.—**D.** Imported in logs which have been deprived of the bark and the yellowish sap-wood; these logs are very heavy and hard, externally bluish-black, internally reddish-brown, coarse-grained, but susceptible of a good polish. The drug consists of chips or coarse raspings of a brownish-red color, the different particles sometimes showing a greenish sheen or luster; taste sweetish, astringent, and odor faint, agreeable.—

C. Tannic acid and hæmatoxylin, a coloring principle much used as a stain in microscopical work.—**U.** Logwood is used as an as-

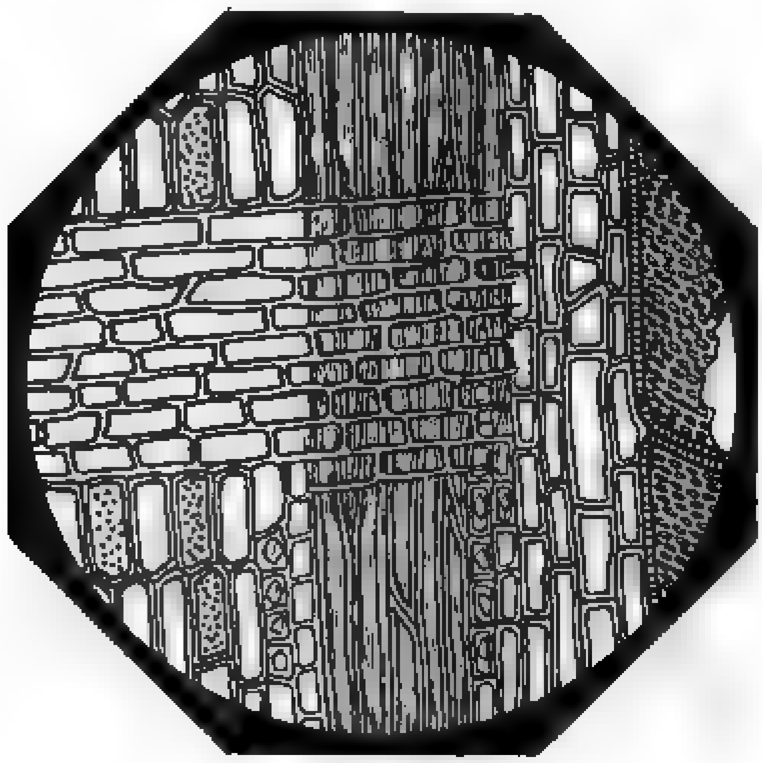


Fig. 221.

tringent, mainly in the form of extract, of which the dose is about one gram. It is also used in the arts as a dye-stuff.

The figure shows a radial section of the wood.

Lignum Citrinum

N. Fustic.—**O.** A yellow dye-wood obtained from *Morus tinctoria (Chlorophora tinctoria); Urticaceæ.*—**H.** West Indies and South America.—**D.** The stems deprived of bark and most of the sap-wood are imported in large, heavy logs, which are brown externally and yellowish-brown internally. In the trade it occurs in shavings or raspings of a deep yellowish color.—**C.** Fisetin (fustin? morin?), yellow pigments used to dye fabrics yellow. Not used as medicine.

BARKS

Botanically, bark is that part of an exogenous plant-axis (stem or root) which is outside of the cambium zone.

From the standpoint of the pharmacognosist, however, we must

modify and limit the meaning of the word "bark," and we define it as *that part of a woody exogenous plant-axis* (stem or root) *which grows outside of the cambium zone, and which is detached from the wood-cylinder at the cambium zone, so that it is an article of trade by itself.*

The Latin word *cortex (icis,* 3, m.) means "bark" as well as "rind" or "peel" and is applied as a title to the class of drugs now under consideration, as well as to the rinds of fruits, as when we speak of *cortex aurantii, cortex granati,* etc. In English we

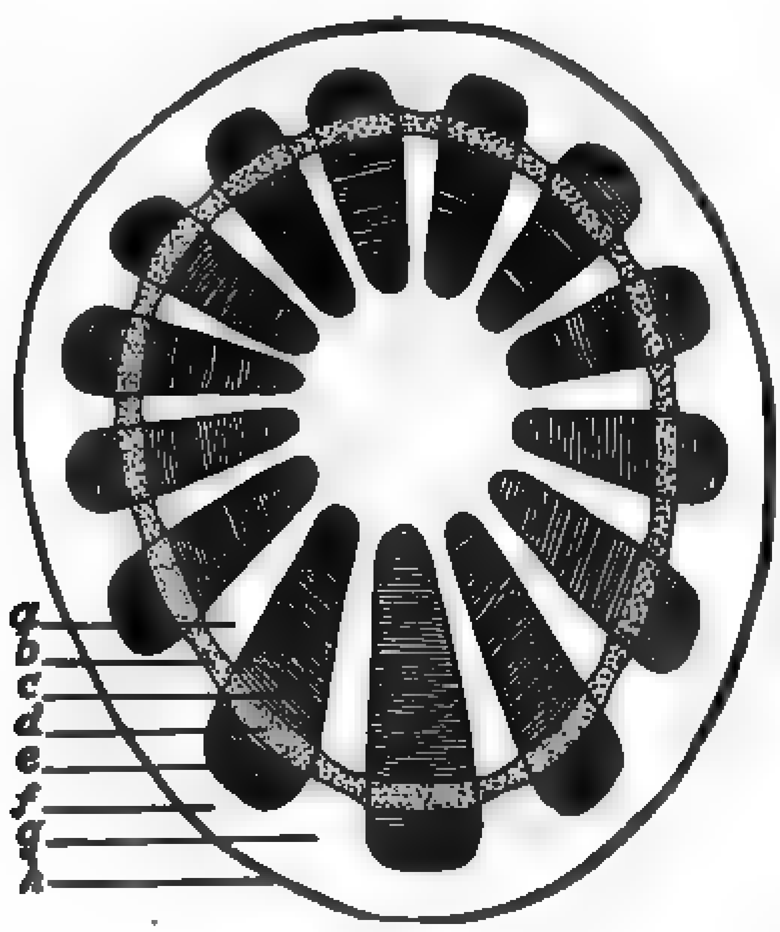


Fig. 222.

make a distinction between these widely different structures, calling them by different names, but the use of the same word in the Latin titles leads to confusion, and the student should fix in his mind the conception of "bark" as being only that part of an exogenous plant-axis just described.

We have already studied the structure of stems and roots in the earlier part of these notes, but we must now again consider some facts already mentioned, with especial reference to this class of drugs. The accompanying figure represents somewhat diagrammatically the structure of an exogenous plant-axis; the

cambium layer *(d)* separates the wood-cylinder, which consists of the pith, xylem *(c)* and medullary rays *(a)*, from the bark. The latter consists of an outer epidermis in the young plant, or a corky layer *(h)* in older plants; next within this is a layer of parenchyma cells *(f)* and then a circle of alternate bast portions of fibro-vascular bundles *(e)* and outer parts of medullary rays *(g)*.

The barks of commerce are rarely obtained from first year's twigs with a structure as represented in section in the drawing. In perennial exogenous stems a new ring of wood is formed each year from the inner part of the cambium, the *annual rings* being thus added one after another; the fibro-vascular bundles divide and subdivide laterally, so that even after many years the width

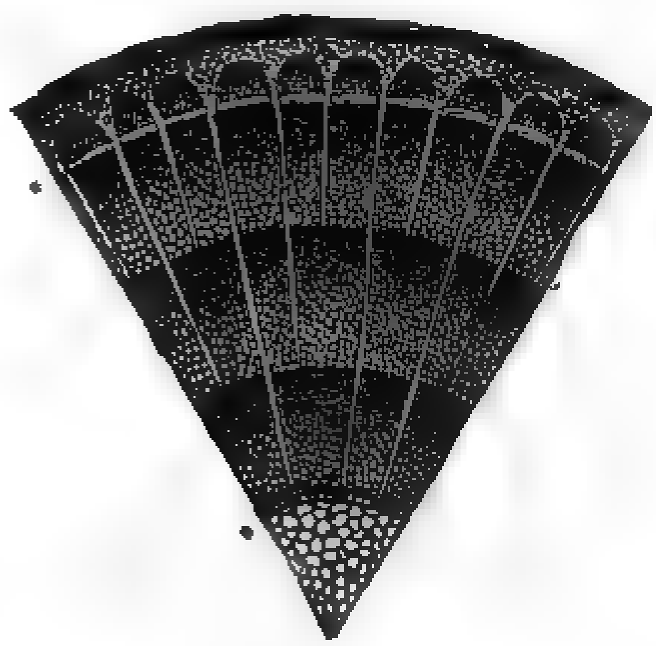


Fig. 223.

of each bundle is no more, and perhaps even less, than at the end of the first year. At the same time the cambium cells are forming new bark, and if we examine a section of an endogenous stem of several years' growth we find it to appear similar to the section represented in Fig. 223, in which the asterisk indicates the cambium zone, all within which is conventionally spoken of as "wood" while all without it is "bark."

If we cut a willow twig in spring, during the time of rapid growth when the tissues are fresh and soft, choosing a straight, smooth piece and preferably a single internode for the experiment, and then beat the surface gently with the side of the knife-handle, we bruise and loosen the cambium cells so that we may

slip a tubular outer piece from the solid cylinder of wood; the tube thus separated is the bark. If we make transverse sections, first, of the whole thickness of a willow twig, then of a piece of the bark and another of the wood-cylinder from which the bark was removed, as explained, and compare them with each other, we obtain a good conception of the relation of the bark to the other parts of the plant-axis. We see that the wood-cylinder consists of the pith, the *xylem* or wood portions of the fibro-vascular bundles and the medullary rays, as far outward as the cambium layer; and on the outside we find portions of the cambium tissue which was torn in removing the bark; we also see that the bark consists of the *phloëm* or bast portions of the fibro-vascular bundles alternating with the prolongations of the medullary rays, of a layer of parenchyma surrounding them, and an outer corky layer, while on the inner side we find also remnants of torn cambium tissues.

After this description it is almost superfluous to add that the arrangement of the endogenous plant-axis is such that there can be no bark in the pharmacognostic sense of the word in monocotyls.

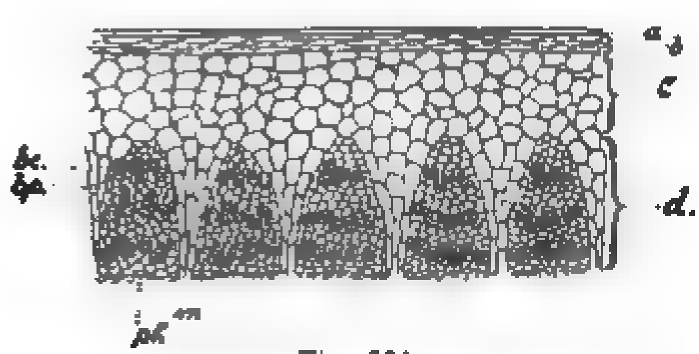


Fig. 224.

Let us now examine this diagram of a section of bark. A typical bark consists of three layers. The outer layer is *epidermis* in young branches *(a)*, under which a layer of cork or *suber* *(b)* soon forms, and in somewhat older barks the epidermis disappears and cork alone remains; this layer is called the "outer bark" *(exophlœum)*. Next within this corky layer or *outer bark* is a layer of parenchyma cells *(c)* formed by the apparent extension, broadening and merging into each other of the medullary rays; in reality these cells, together with the medullary rays and pith, are fundamental tissue. This layer extends from the cork in-

ward to an imaginary line drawn to connect the outer points of the bast portions of all the fibro-vascular bundles in the transverse section, and this parenchyma constitutes the "middle bark" *(mesophloeum)*. The third layer *(d)* consists of the phloëm-portions or bast-portions of the fibro-vascular bundles *(ph)* and the intermediate medullary rays *(m)* from the imaginary line just described inward to the cambium layer; it is called the "inner bark" *(endophloeum* or *liber)* and consists of alternating wedges of bast and parenchyma, the wedges of bast having their base or broader ends inward and the points outwards, and the fundamental parenchyma wedges *vice versa*. The bast consists of bast-parenchyma *(bp)*, which differs in the shape and size of its cells from the fundamental parenchyma, and bast-cells *(bc)*; it also contains sieve-ducts, which, however, are of little or no practical importance to the pharmacognosist. The arrangement of the bast-parenchyma, bast-cells and medullary rays or fundamental tis-

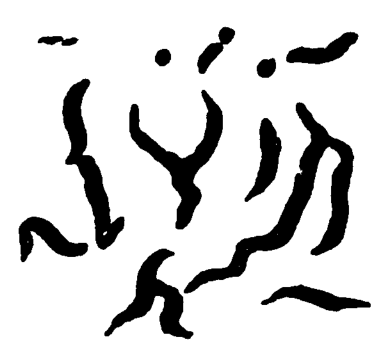


Fig. 225.

sue and their relations to each other give the peculiar appearances to the transverse sections of barks by which we group them.

The outer surfaces of barks offer several points of interest which may be of diagnostic value. Formerly much attention was given to the study of the parasitic cryptogams, lichens and mosses, which grow on the surfaces of trees, and which were supposed to be characteristic features of certain barks. At the present time we give but little heed to these forms of vegetation, although some of them are peculiar in shape and possibly of some diagnostic value; the accompanying illustration (Fig. 225) shows a lichen, the "graphis elegans," so-called from its resemblance to (Chinese) writing, which occurs on Saigon cinnamon; the little black spots on the white corky layer of Cascarilla are also cryptogamic plants. While it is possible that a closer study of this subject, not only in connection with barks, but also with

other plant-parts, might furnish some data of value for the identification of powdered drugs, yet the former plan to use these lower plant-forms to identify whole barks is about as if someone would suggest that because the thumb-marks of no two persons agree in shape, therefore the lines and figures of the thumb might be used in recognizing our friends. A finger-mark in blood on the wall of a room in which a murder was committed might lead to the conviction of a murderer, but we recognize our friends by face and features other than thumb-marks; so we use other coarser and equally characteristic features to identify drugs, rather than by a study of the cryptogamic parasites. The mere presence or absence of such growths may, however, sometimes be useful in distinguishing between the barks of stems (with cryptogams) and the barks of roots (without cryptogams) of the same plant.

Cork proper consists of true cork-cells *(suber)* which may be from a few to a few hundred or thousand cells in thickness. These cells are practically impervious to water and serve to prevent evaporation of moisture from the stem while en route from the roots to the leaves. As the stem grows in thickness this corky layer becomes fissured in a manner which enables the woodman to recognize the varieties of trees in the forests or fields by their barks, and often enables pharmacognosists to recognize barks by these same characteristics. In some barks this corky layer cracks off after a while, but a thin protecting layer remains, from which thicker layers are soon reproduced; meanwhile the middle bark forms new cells to adapt the bark to the growing circumference of the plant, so that while the bark grows in all directions it yet retains the structure of a typical bark with the three layers, the *outer, middle* and *inner* barks.

In other plants, however, the bark continues to grow only or mainly at the cambium zone and in this case, as the circumference enlarges and fissures form, these extend into the middle bark or even into the inner bark, until large pieces of bark finally fall off. This would leave the stem in a denuded condition, somewhat like an open ulcer on an animal surface, if nature had not provided a plan to prevent this. A layer, or layers, of secondary cork *(rhytidoma)* dips down from the surface of the bark through the middle and later on through the inner bark

and emerges again at some little distance; such secondary cork layers are shown in this section of cornus florida bark (Fig. 226). When formed, nourishment or sap is cut off from the tissues outside, and the latter are sphacelated or necrosed, i. e., cut off from the living tree, much like a sphacelus in a spontaneous amputation or slough in an animal, or in the same manner as deciduous leaves are shed in fall. As far as external appearances go, these masses of fissured and necrosed bark tissue resemble the fissured masses of true cork previously described, and both formations are called "Borke" by German botanists; no better term having been suggested it has also been adopted by English writers and the term is frequently met with; but care should be taken that no confusion be permitted by the similarity of the English terms "bork" and "bark."

The "bork" of plants sometimes peels off in sheets or leaves

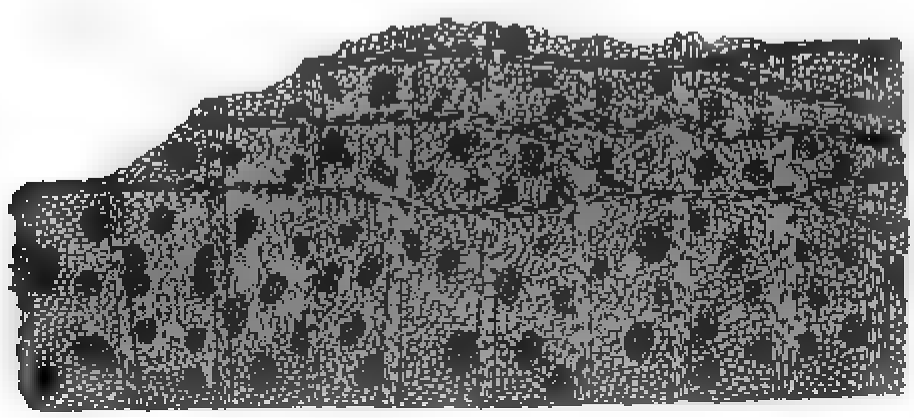


Fig. 226.

when it is called "liber," from a Latin word for book. Liber is seen in the grape-vine, for example. "Liber" usually means inner bark.

The falling off of the *bork* frequently leaves peculiar markings or depressions, the latter sometimes decidedly conchoidal in shape, or the *bork* itself may appear in nodules or warts, or it may peel off in more or less extended patches or flakes, any of which conditions may serve as aids for recognition of the identity of the several barks.

In distinguishing between the barks of stems and roots we may also be aided by peculiar markings, traces of former leaf-scars or more rarely by the presence of buds on stem barks.

The *middle bark* consists mainly of soft-walled parenchyma

cells, which appear tangentially stretched in a transverse section. When cells which are not prosenchymatous in shape, that is, which are not long or fusiform but of nearly equal diameters in all directions, become thickened by sclerogen layers, whether aggregated in large numbers as in the stones of fruits or scattered among surrounding parenchyma, these sclerenchymatous cells are called "stone-cells;" a few such cells from a gritty particle in the flesh of the pear are shown in Fig. 227, and the typical appearance of sclerenchymatous cells will be readily recognized. Stone-cells of similar character are found in the middle bark of various plants, either singly, scattered as

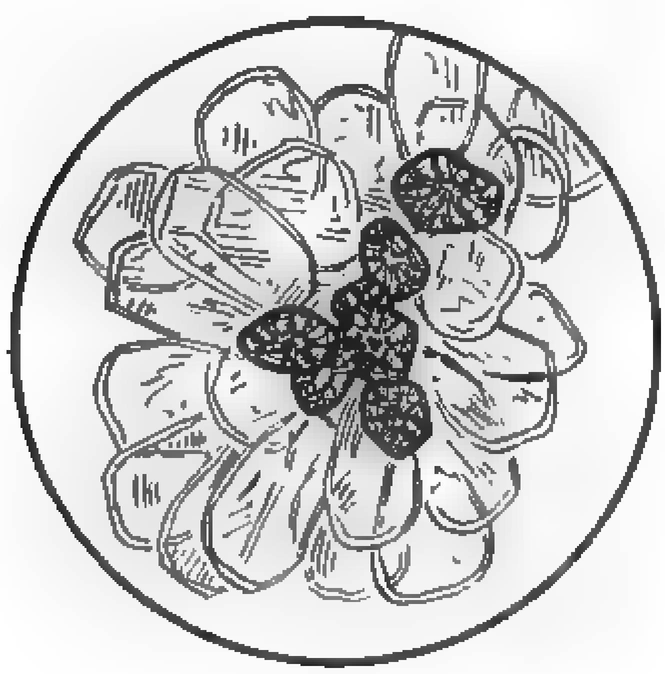


Fig. 227.

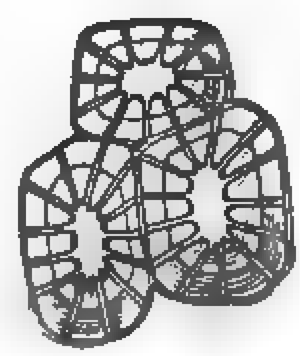


Fig. 228.

in the Cinchonas or in large clusters or even in almost solid layers, as in the stone-cells (so-called "star-cells") from Ceylon cinnamon, shown in Fig. 228.

When present such stone-cells afford means for identifying the drug both in its whole and in its powdered condition, and of course in differentiating between different barks the *absence* of stone-cells in the middle bark may be just as good a characteristic in some cases as the *presence* of them is in other cases.

Another feature of the middle bark consists in the presence (or absence, as the case may be) of larger ducts, cells or spaces, latex-ducts, resin or oil cells or ducts, or air-spaces, tracheids, etc. In fact cinchonas may be grouped on structural grounds

into divisions based upon the presence or absencé of both stone-cells and latex-ducts or air-spaces.

The *inner bark* consists of alternate wedges of medullary rays which are narrow at the cambium zone and gradually widen and merge with the middle bark and of bast portions of fibro-vascular bundles which are widest at the cambium zone and gradually grow smaller and cease at the margin of the middle bark; in fact the demarcation between middle and inner bark is an imaginary line uniting the outer points of the bast bundles, as seen in a transverse section of bark.

The medullary rays consist of cells similar to or identical with those of the middle bark (both being fundamental tissue), but they are frequently elongated in a radial direction near the cambium zone, gradually becoming shorter in the radial direction until at or near the confluence with the middle bark the radial diameter is less than the tangential diameter and the cells are tangentially stretched as in the middle bark itself.

The most characteristic features of the inner bark are found in the bast or phloëm portions. In the living plant this part is actively concerned in the circulation of the fluids and special ducts, the so-called sieve-ducts, are here found. These ducts are formed of elongated cells which are separated by partitions of thickened material deposited in a sieve-like manner, the thinner parts, or meshes, consisting of soft cell-wall through which osmosis can take place readily. To the pharmacognosist these ducts are of little or no importance, except that in the examination of powdered barks the appearance of fragments of the sieve-like plates might possibly be characteristic in some few instances.

Most of the bast consists of parenchymatous cells which are usually much smaller in diameter on transverse section, but elongated in the direction of the plant axis, therefore in a longitudinal direction. Some barks, however, contain also a large proportion of prosenchymatous cells or strings of cells in the bast which render the bark very tough, as in simaruba or mezereon. In still other cases the phloëm may be more or less lignified, in which case the appearance of the anastomosing bast bundles, as seen on the inner surface of the bark of wild cherry (Fig. 229), for example, may closely resemble the outer appearance of the wood-cylinder as figured under woods; in fact the

Fig. 229.

structures of *phloëm* and *xylem* correspond and fit each other accurately in the growing plant. In such cases the parenchyma of the medullary rays often shrinks and forms fissures or depressions on the inner surface of the bark, especially if the bark is

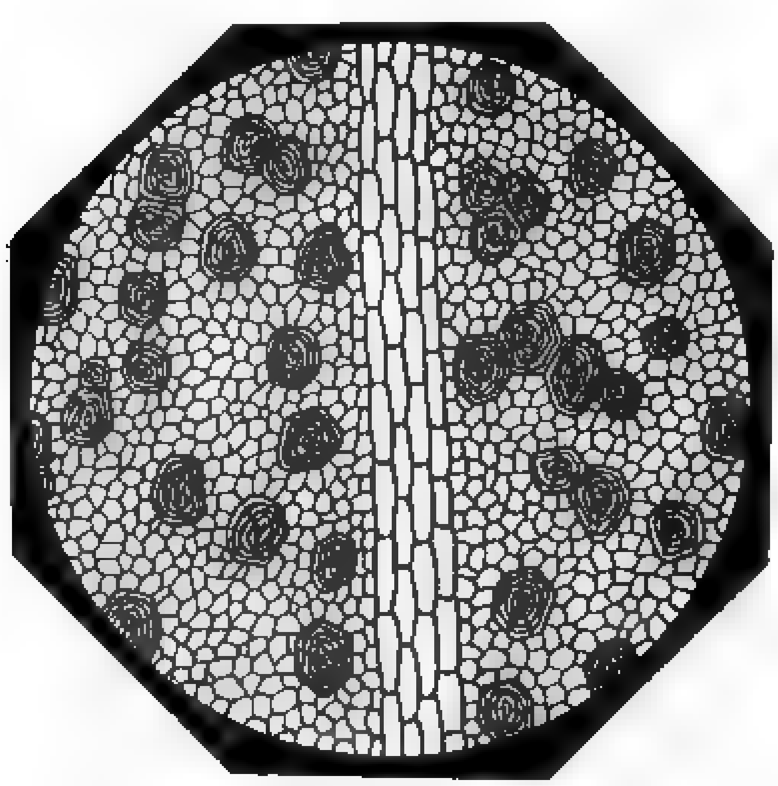


Fig. 230.

too rigid to curl or quill inwards. (Fig. 229, enlarged 4 diameters.)

Still other and perhaps the most characteristic structures when present are the bast-cells, which are found in the phloëm or bast. On transverse section these appear to be similar to the stone-cells of the middle bark, as seen in Fig. 230, of bast-cells from calisaya bark, but on making a longitudinal section of the bark these bast-cells are seen to be prosenchymatous in form, and they belong to the mechanical tissue-system, giving strength and support. This is shown in the longitudinal section from calisaya bark, shown in Fig. 231.

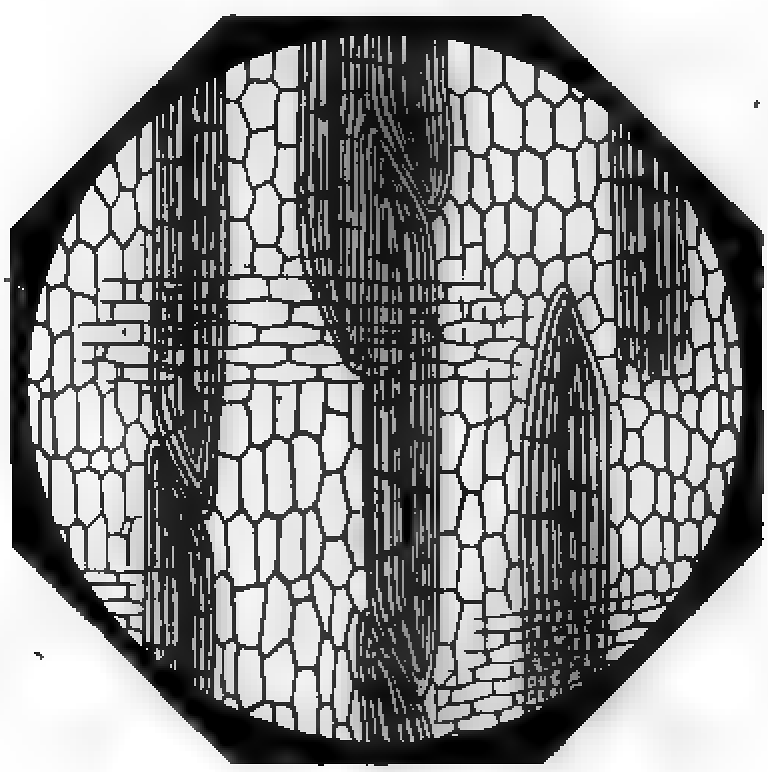


Fig. 231.

The form, as well as the arrangement of the bast-cells, singly, in clusters, etc., may give peculiar appearance to the section of a bark; in the transverse section of calisaya bark just shown, we see the bast-cells irregularly scattered, either singly or in quite small clusters; while in the section of cotton-root bark the bast-cells and bast-parenchyma are arranged in alternating layers, as shown in Fig. 232. Bast-cells, therefore, are important diagnostic features in the determination of the identity of barks.

Most of the parenchyma cells of the middle and inner bark contain starch, as well as the various medicinally valuable ingredients like alkaloids, etc. Some barks contain special mucilage

cells, which are usually larger than the other parenchymatous cells, or special oil cells which are sometimes smaller than the other parenchymatous cells. Alkaloids are contained in all the various cells, but probably mostly in the parenchyma of the inner bark. The outer bark, even when formed of necrosed tissues of inner bark, contains comparatively little of medicinal value and is therefore generally to be rejected if present in the form of "bork;" but if not present as bork, it constitutes part of the drug and the whole bark is to be used.

We are now prepared to study some facts in regard to the

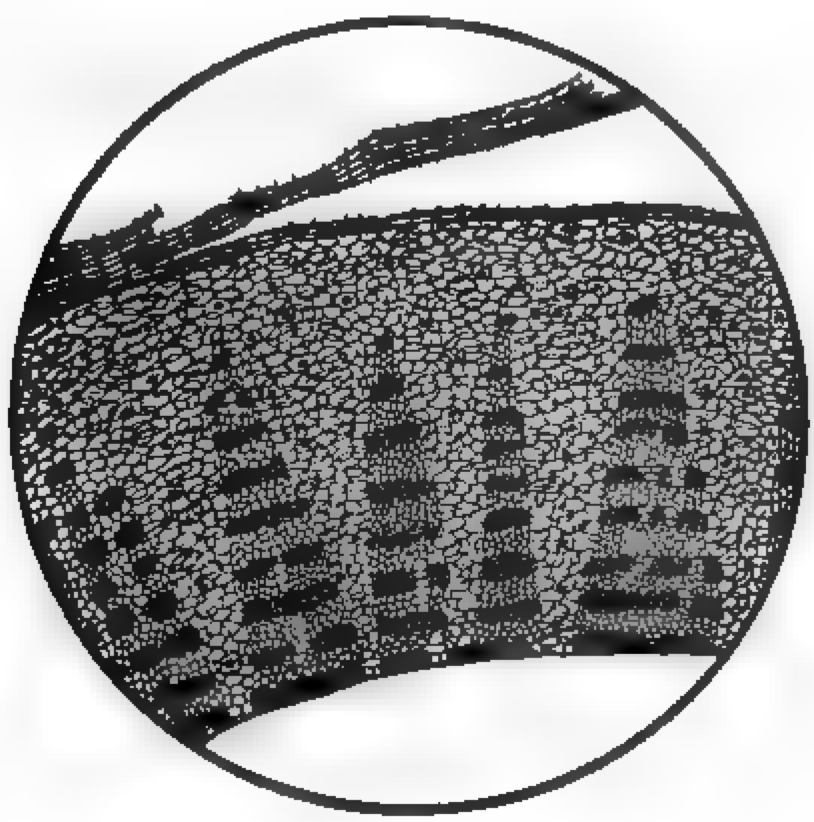


Fig. 232.

coarse appearances of bark, after which the principles of classifying them will be considered.

It is of course well known that soft tissues of fruits, etc., become darkened when exposed to the oxidizing influence of air; a piece of peeled apple becomes yellowish and eventually brownish in a very short time after the protecting epidermis has been removed and dried fruits of almost all kinds are darker colored than the fresh pulp or flesh of the corresponding fruits. So also the cambium tissue, which is made up of very delicate cells and which is usually white or colorless, is readily oxidized and becomes darkened by exposure to air. Nearly all barks, when

first removed from the stems, branches or roots, are white on their interior surfaces, but the oxidation after removal changes their colors to those which are characteristic of the commercial barks; thus, canella alba remains nearly white, slippery elm becomes pale brownish-white, sassafras changes to reddish or bright rust-brown, cinnamon brownish and old buckthorn bark almost blackish or purplish-brown, so that the tints or colors of the interior surfaces of barks become of diagnostic value.

The appearance of the outer surfaces is not greatly altered except when the natural outer portions of cork and bark are removed and only the inner bark is sent into trade, when the outer surface differs from the fresh appearance in the ungathered bark, practically in the same manner as the changes in appearance of the inner surfaces occur. This is the case, for instance, in Cassia and Ceylon cinnamons, in slippery elm, etc., which are described as "inner barks."

As soon as a bark is separated from the stem or root it commences to lose moisture, and in drying out it naturally shrinks. The shrinkage will be greatest in that part of the bark which contains the softest cells, therefore, more in the inner than in the outer portions. If the outer portion or bark has been removed, the shrinkage will be even or nearly even from both surfaces and the pieces of bark will remain more or less flat, as in slippery elm, but in some barks the flat pieces are so in consequence of pressure applied, as in the larger pieces of yellow or red cinchona, especially as formerly brought from South America.

As the softer and more succulent inner parts of barks lose their moisture, this generally causes the bark to curl inward and according to the degree of curvature different descriptive names are given to the barks. When the curvature is slight, as in Fig. 233, the pieces are called "troughs" or "curved pieces;" if the bark is rolled from one side into a tube or cylinder, as in Fig. 234, this is called a "quill" or "simple quill," while if it is rolled inward from both sides as in Fig. 235, it is called a "double quill."

If while drying, the bark does not readily yield to quilling, it may peel off, leaving peculiar depressions on the outer surface of the bark, as shown in Fig. 236, and as may be seen in Pome-

granate bark (Fig. 348). But an unequal shrinking of bast and medullary rays may cause longitudinal grooves or wrinkles on the inner surface, or even fissures, as in Fig. 237, also shown in

Fig. 233.

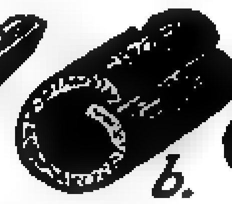


Fig. 234.

Fig. 235.

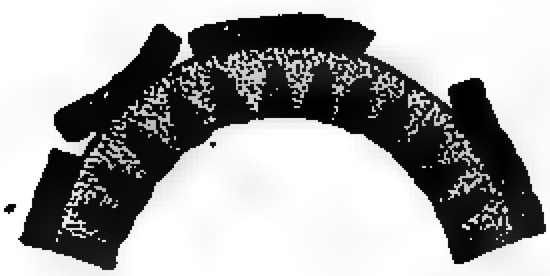


Fig. 236.

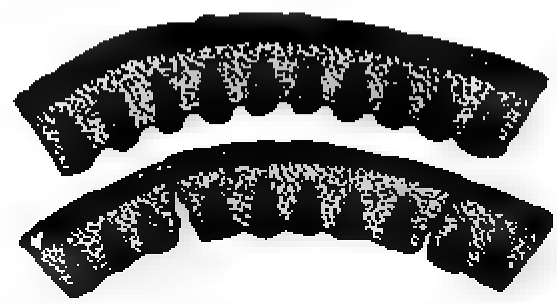


Fig. 237.

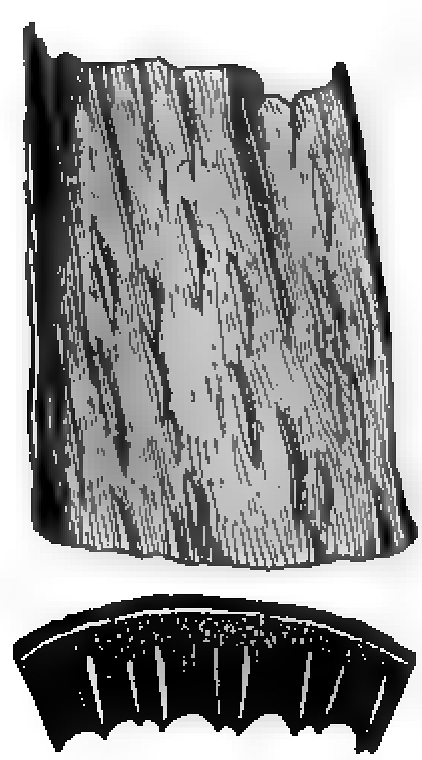


Fig. 238.

a drawing of the inner surface of wild cherry bark (Fig. 229); or ridges may be formed, as in alnus rubra, the reason for which will be readily understood from an examination of Fig. 238.

In some cases, as in cascarilla, the bark does not separate

readily from the stem and must be chipped or cut from the latter; in such cases some pieces may consist only of a portion of the thickness of the bark, while other pieces may consist of more than the bark, having splinters of wood adherent on the inner surface, while yet other pieces may have both conditions present in different parts. In some other kinds of barks the suber or epidermis may be very thin or even soft, while the bast is rigid, or as just explained, bits of wood may adhere; the shrinkage under all these conditions will take place probably most in the middle bark and irregular torsion will be exerted on both inner and outer surface tissues, the result being pieces of bark which are irregularly bent and twisted, and it is to this kind of pieces that we should restrict the term "curved pieces" or "irregularly curved pieces."

It will readily be understood that the main characteristics of structure which determine color or shape of the pieces of commercial barks are inherent attributes of the plant from which the bark is obtained, and that while the size of the stem or branch or root from which the bark is obtained must, in a limited way, have influence on the shape (owing to more or less heavy layers of outer bark mainly) or the rapidity of drying may to some extent modify the tint of the color, or the season of the year at which the bark is gathered may influence the bark in various ways and especially as regards its constituents, yet the essential characteristics, such as histological structure, which are of pharmacognostic diagnostic value will necessarily be present in each bark, no matter when or how gathered.

Various methods of classification or grouping have been used, of which those based on structural features are, of course, most exact and desirable; but other classifications have also been used and it is well to use them all in combination, as the barks present many difficulties in this regard.

Schleiden, one of the founders of the modern study of pharmacognosy, in his work published in 1857, classified barks as follows:

ORD. I. AROMATIC BARKS

Cinnamon, canella, etc.

ORD. II. BITTER AND ASTRINGENT BARKS

A. Thin barks.—Willow, oak, horse chestnut, buckthorn, etc.
B. Thick barks.—Simaruba, angostura, quassia, pomegranate, etc.

ORD. III. ACRID BARKS

Mezereon.

ORD. IV. CINCHONA BARKS

(Recognizable by the peculiar bast-cells; this group was, therefore, based on structural characteristics.)

Prof. Maisch, in his valuable work on "Organic Materia Medica," classifies barks thus:

SECT. I. TASTE BITTER AND ASTRINGENT

Cinchonas, dogwood, magnolia, black alder, wild cherry, barberry, willow, witchhazel, cramp bark, black haw, etc.

SECT. II. TASTE ASTRINGENT

White oak, black oak, blackberry, and pomegranate.

SECT. III. TASTE BITTER, NOT AROMATIC

White ash, simaruba, quassia, condurango, buckthorn, cascara, Jamaica dogwood, butternut, quebracho, etc.

SECT. IV. TASTE ACRID AND PUNGENT

Prickly ash, mezereon, cotton-root, coto, wahoo, quillaja, etc.

SECT. V. MUCILAGINOUS

Slippery elm.

SECT. VI. AROMATIC (SOME ALSO BITTER) WITH RESIN-CELLS

Cinnamon, sassafras, canella, angostura, cascarilla, etc. (This is the only group of barks in Maisch's system which is based, in parts at least, on structural characteristics.)

Prof. Culbreth, in his work on "Materia Medica," adopts Prof. Maisch's system, but does not apply the system in the book itself.

A. BITTER AND ASTRINGENT.
B. ASTRINGENT.
C. BITTER, NOT AROMATIC.
D. ACRID AND PUNGENT.
E. MUCILAGINOUS.
F. AROMATIC, WITH OIL OR RESIN-CELLS.

Prof. Sayre proposed the following system, but did not apply it in his work on "Materia Medica."

CLASS I. AROMATIC.
A. DEPRIVED OF CORKY LAYER.
B. WITH PERIDERM.
CLASS II. ACRID.
CLASS III. BITTER.
CLASS IV. BITTER AND ASTRINGENT.
CLASS V. ASTRINGENT.
CLASS VI. MUCILAGINOUS.
UNCLASSIFIED.

Prof. Kraemer uses the following system:

BARKS	WITH PERIDERM	A. Yellowish to dark brown. B. Grayish to grayish black. C. Greenish in color.
	WITHOUT PERIDERM	A. Aromatic odor and taste. B. Without aromatic properties.

Prof. Berg (1857) furnished the first system of classifying barks strictly according to anatomical or structural characteristics. To examine the barks according to his method, transverse sections must be made for microscopical examination.

I. BAST WITH SCATTERED OR ISOLATED BAST-CELLS, SOMETIMES IN RADIAL ROWS, LESS OFTEN IN SMALL GROUPS

II. BAST RADIALLY STRIATED

A. Bast indistinctly striated.
B. Bast distinctly striated.
C. Bast regularly wedge-shaped.
D. Bast with horny bast-fibers.

III. BAST QUADRATICALLY MARKED BY PARENCHYMATOUS AND BAST RAYS WHICH CROSS EACH OTHER

A. With horny bast-fibers.
B. Evenly marked without any distinct bast-fibers.

IV. BAST TANGENTIALLY STRIATED

A. Bast firm and dense, moderately thick.
B. Bast thin or thick, white, mealy, finely striated.
C. Bark thin, flexible, reddish-brown.

V. BAST NEARLY EVEN, WITHOUT DISTINCT STRIATION

A. With faint brownish wedges.
B. Without wedges.

VI. BARK RASPED, PALE BROWN

VII. CORK ("BORK") THICK, PALE BROWN

In this system some of the subdivisions were made to accommodate the placing of single barks, as for instance the last group or class (VII) which was thus created for only one article, cork, which, however, is not a drug in the proper sense of the word.

The system of grouping barks used in this book was introduced by the author in his "Notes on Pharmacognosy" published serially in a journal about twenty-five years ago, and in bookform some years later. The system is based on the work of Berg, but it is simplified in such a manner that it does not require microscopical preparations.

To apply the system here used it is only necessary to cut a bark to be examined, so as to make a *smooth transverse section*, which is to be examined *by reflected light* with a low power lens magnifying from 5 to 10 diameters. If the end of a piece of dry bark cannot be cut smooth enough, it may be necessary to soak it in water first.

No cleared or finished microscopical section need be made; in fact, such sections are misleading since cleared sections are all "radially striate;" reflected light from the opaque end is necessary for a satisfactory examination, which therefore can be made in most instances in a very few minutes.

METHOD OF GROUPING BARKS

BARKS	Whole	Bast with isolated bast-cells	XL
		Bast radially striated	XLI
		Bast tangentially striated	XLII
		Bast quadratically striated	XLIII
		Bast without striation	XLIV
	Rasped		XLV

The characteristics of these groups will be described under the separate groups.

GROUP XL

CINCHONA BARKS

This group consists of the dried barks of *Cinchona Ledgeriana, Cinchona Calisaya, Cinchona officinalis,* and of hybrids of these with other species of *Cinchona; Rubiaceæ.* A bark of this group may be known by placing about 0.1 or 0.2 gram of any cinchona

bark in a test-tube and then heating in the flame of a bunsen burner; the products of the destructive distillation condense on the sides of the glass in the upper part of the test-tube as drops of a red liquid, which is characteristic of the cinchona barks.

A very thin sliver may then be cut with a sharp knife or razor from the end of one of the pieces, as nearly as possible in a transverse direction; place this thin fragment on a microscope slide, drop on it a little solution of potassium hydroxide and cover with a cover glass; when it clears it will be easy to recognize the

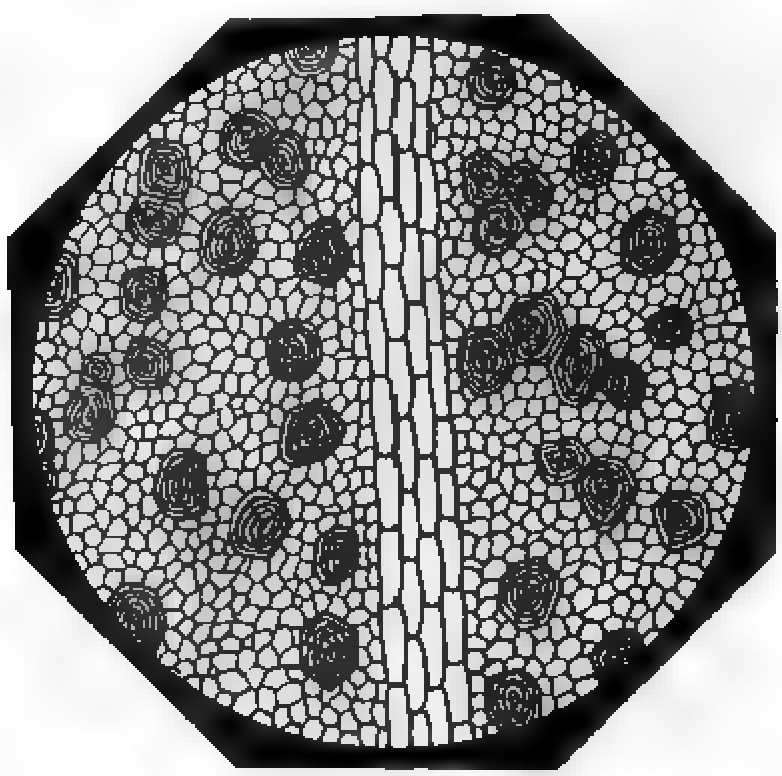


Fig. 239.

peculiar bast-cells and their more or less scattered or isolated distribution in cinchona barks.

Only young barks have all three layers, while the older barks usually consist altogether of bast, or bast and bork.

When all three layers are present the outer layer consists of cork. The middle bark consists of parenchyma cells, which are stretched tangentially and which contain starch and brownish-red coloring matter; in this layer there are occasionally found isolated stone-cells formed by the thickening of the cell-walls of some of the parenchyma cells, and also sometimes intercellular spaces or ducts which contain sap in younger barks, or air in older barks. The inner bark, which is continuously formed from the cambium, consists of bast rays separated by medullary rays; the bast portions contain peculiar cells, bast-cells, which

have so characteristic forms that they are ready means for recognizing cinchona barks. The appearance of these cells in Calisaya bark is shown in transverse section in Fig. 239 and in longitudinal section in Fig. 240; under the polariscope a polarization cross is seen in a transverse section of such a cell, as shown in Fig. 19 on page 84.

The cinchona barks may be grouped according to whether or not they contain stone-cells in the middle bark, and each of these groups may be divided again according to whether or not they

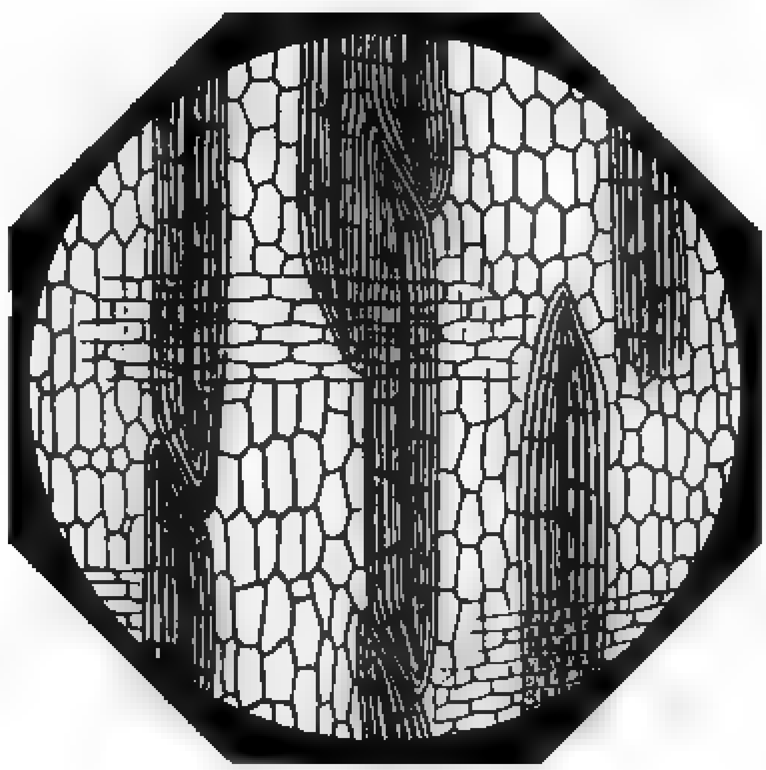


Fig. 240.

contain sap or air spaces in the middle bark. It is beyond the scope of these notes, however, to go into details in this regard further than giving a few examples:

With stone-cells	With sap-spaces	C. amygdalifolia.
		C. ovata.
		C. umbellata.
	Without sap-spaces	C. lancifolia.
		C. macrocalyx.
		C. microphylla.
Without stone-cells	With sap-spaces	C. Calisaya.
		C. lutea.
		C. Uritusinga.
	Without sap-spaces	C. lanceolata.
		C. micrantha.
		C. succirubra.

The cinchona barks have also been grouped as "Yellow Cinchona," "Red Cinchona" and "Pale Cinchona," of which the first two groups were official in the U. S. Pharmacopoeia of 1880 under the titles of "CINCHONA FLAVA" and "CINCHONA RUBRA;" only *C. Calisaya* was recognized as yellow cinchona and *C. succirubra* as red cinchona, pale cinchona not being official. In the U. S. P. of 1870, however, pale cinchona, or "CINCHONA PALLIDA" was also officially recognized, *C. officinalis* and *C. micrantha* being recognized as the sources.

According to the U. S. P. of 1890, "CINCHONA" (*Var.:Ledgeriana, C. Calisaya and hybrids)* should contain not less than 5 per cent of total alkaloids of which at least 2.5 per cent should be quinine. This was changed in the U. S. P. VIII, to the requirement that it should not contain less than 5 per cent total anhydrous alkaloids, and at least 4 per cent of anhydrous ether-soluble alkaloids. This is retained in the U. S. P. IX.

"CINCHONA RUBRA" *(C. succirubra)* should contain 5 per cent of total alkaloids, but no special requirement of the quinine strength was made in the U. S. P. 1890; this was changed to "not less than 5 per cent of anhydrous alkaloids" in the U. S. P. VIII, which is also the requirement of the U. S. P. IX.

The following list states the origins of the different kinds of Cinchonas:

Pale Cinchonas: *C. officinalis, C. micrantha, C. subcordata, C. umbellulifera, C. purpurea, C. Uritusinga, C. Condaminea* (Loxa), *C. macrocalyx, C. glandulifera, C. microphylla, C. scrobiculata* (young bark), *C. nitida, C. ovata,* etc.

Red Cinchonas: *C. succirubra, C. coccinea,* etc.

Yellow Cinchonas: *C. Calisaya* (and hybrids with *C. Ledgeriana), C. Boliviana, C. scrobiculata, C. pubescens, C. lancifolia, C. cordifolia, C. lutea, C. pitayensis,* etc. The bark of *C. Calisaya* was considered best, and was therefore called *Cinchona regia* or *China Regia,* "Royal Cinchona."

The Cinchona barks contain several alkaloids, of which quinine is the most important; in addition to *quinine* there are *quinidine, cinchonine, cinchonidine, quinamine, conquinamine,* etc. These alkaloids occur in the drug in combination with *cincho-tannic* and *quinovic acids,* of which the first-named is astringent. Then there are amorphous substances, *quinovin* and *cinchona red,* the first

being a bitter principle, while the latter is a product of cinchotannic acid and is especially abundant in the red barks.

The Cinchonas are natives of South America, but are now very successfully cultivated in Java, India, and Ceylon, and the cheapness of Cinchona barks and of alkaloids of Cinchona is due to the success achieved in these Asiatic plantations. By cultivation the barks are not only more beautiful, but also of a higher grade; the U. S. P. 1880 requirement of "at least 3 per cent of alkaloids" is now too low for pharmaceutical barks, 5 per cent being the minimum now, but for manufacturing purposes barks are utilized that are often quite low in alkaloidal contents. The price of cinchona barks is determined now by the results of an assay.

In the U. S. P. 1870 three Cinchona barks were recognized: Yellow Cinchona, Red Cinchona, and Pale Cinchona. While these names are no longer the official titles, they are still trade varieties of the barks used by pharmacists and we shall now consider them.

Quills or troughs with brownish-gray cork; brownish-yellow internally .... **Cinchona.**

Thick, flat pieces, usually without cork, splintery, fibrous, orange-yellow .... **Yellow Cinchona.**

Two kinds, flat and quilled. Similar to above kinds, except that the color is deep reddish-brown .... **Red Cinchona.**

Quills, smaller than the other varieties, grayish-brown externally and internally .... **Pale Cinchona.**

Cinchona

N. Cinchona, Yellow Cinchona, Yellow Peruvian Bark, Calisaya Bark.—**O.** The bark of *Cinchona Ledgeriana*, *C. Calisaya*, *C. officinalis*, and of hybrids of these with other species of *Cinchona; Rubiaceæ*. Formerly only *C. Calisaya* was recognized as the source of true yellow cinchona.—**H.** South America, East India, Ceylon and Java; mainly, however, from Java.—**D.** The Javanese drug, which is the one most commonly used now, comes in quills, double quills, or troughs of various lengths, often up to 30 or 40 cm. or more; the bark itself from 2 to 3 up to 5 mm. thick; outer surface covered with grayish or brownish gray cork, generally fissured both longitudinally and transversely,

sometimes wrinkled or marked with warts on longitudinal ridges; inner surface brownish-yellow or pale cinnamon-brown and finely striate; fracture abrupt in the outer layers and finely fibrous in the inner layers; odor slight and taste bitter and astringent. (Fig. 241.)

The South American drug, when obtained from the smaller

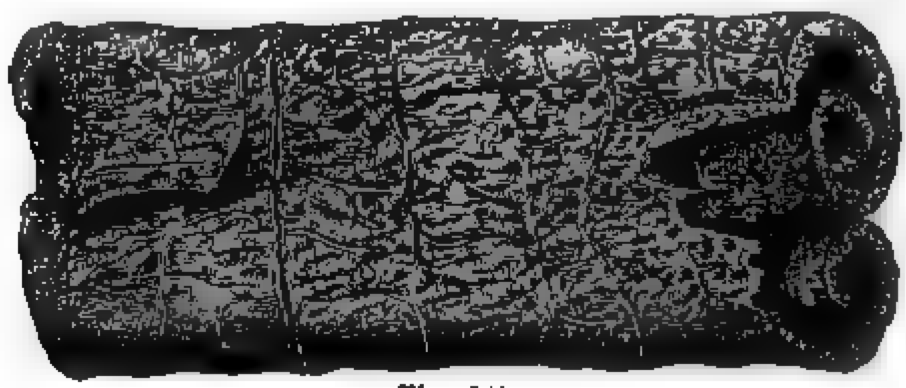
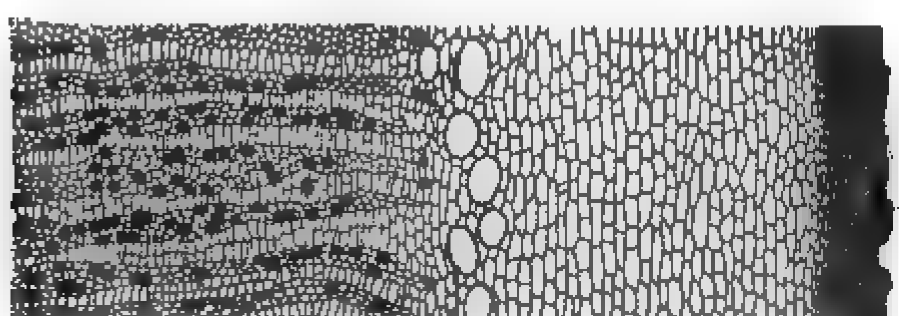


Fig. 241.

branches of the trees, resembles the drug just described; but when obtained from the trunks and larger branches of the trees, as is usually the case, it is called "flat cinchona" and differs in appearance. Flat yellow cinchona is in pieces of various sizes, up to 3 cm. or more thick, consisting mainly of bast, with cork



Cinchona Calisaya.

Fig. 242.

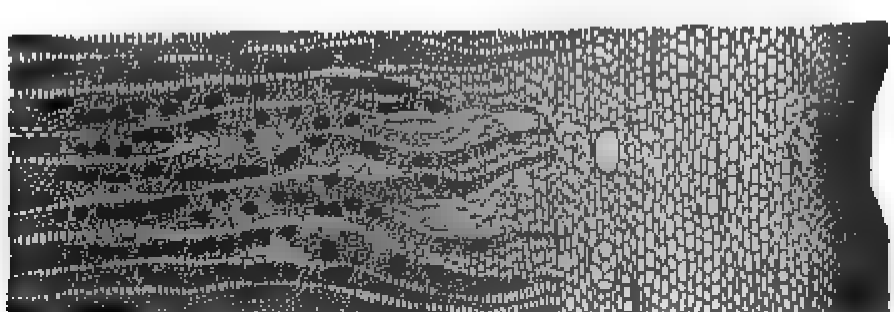
(or rather "bork") occasionally present, but usually without cork; usually the cork is roughly removed with instruments and then both outer and inner surfaces appear alike, orange-yellow, splintery and fibrous; a large proportion of the drug usually consists of small splinters and fragments in which inner and outer surfaces cannot be distinguished; the cork ("bork") when present, is composed mainly of brown parenchyma or bast,

with darker or almost black secondary cork lines; the bast-cells are arranged in radial lines singly or in small groups of two or three, short, thick and yellow.—**C.** Cinchona alkaloids, quinine quinidine, cinchonin, cinchonidine and quinamine, of which quinine is the most important and should constitute at least one-half of the total alkaloids, of which the bark should contain at least 5 per cent; the other constituents are of no importance:—**U.** Bitter tonic, anti-periodic, febrifuge. Dose: 1 to 5 grams, best in fluid extract or in the form of alkaloids and their salts.

Fig. 242 shows a transverse section of a piece of young Calisaya bark.

Cinchona Rubra

N. Red Cinchona.—**O.** The bark of *Cinchona succirubra,* or of its hybrids; *Rubiaceæ.*—**H.** Native in South America; cultivated in East India, Ceylon and Java.—**D.** In quills, double quills, or troughs, varying in length, from 2 to 5 mm. thick, covered on the outer surface with grayish-brown, rough, warty and wrinkled cork, which is sometimes slightly fissured transversely; fracture



Cinchona succirubra.

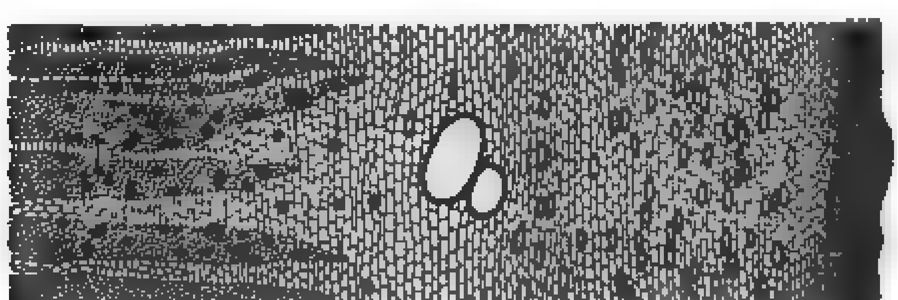
Fig. 243.

fibrous in the inner layers and the inner surface distinctly striate, deep reddish-brown; taste bitter and odor very slight.

The South American flat red bark, now rarely met with in retail pharmacies, resembles the flat yellow bark, except in color, which is deep reddish-brown.—**C.** and **U.** Like those of yellow cinchona; this bark should not yield less than 5 per cent anhydrous cinchona alkaloids.

Cinchona Pallida

N. Pale Cinchona, Loxa Bark, Crown Bark.—**O.** The bark of *Cinchona officinalis* and other varieties of *Cinchona; Rubiaceæ.*—**H.** South America; the varieties furnishing the gray or pale bark are of inferior value and are not now cultivated in Asiatic countries, with the exception of *C. officinalis,* which seems to have materially improved under cultivation.—**D.** Generally in quills from the thickness of a goose quill to that of a finger, rarely larger; epidermis or cork grayish-brown, sometimes wrinkled, or with small or shallow fissures, the inner surface brown or grayish-brown; fracture fibrous; taste bitter and odor faint, but peculiar.—**C.** This bark averages low in its alkaloidal contents, and is especially poor in quinine; it is therefore seldom used except for the manufacture of alkaloids.—**U.** Used as an antiseptic astringent. It contains more cincho-tannic acid than the other



Cinchona ovata.

Fig. 244.

varieties of cinchona and has been used as an ingredient of antiseptic poultices; also internally as a bitter tonic. Dose: 2 to 5 grams, best in the form of fluid extract. Fig. 244 shows a transverse section of *C. ovata,* one of the varieties of pale cinchona.

Cuprea Bark

In the same forests in which the cinchona trees are found in South America, there are also found allied trees *(Remijia pedunculata; Rubiaceæ)* which yield cinchona alkaloids, and which are sometimes even quite rich in quinine. The barks of these trees are brought into the trade as "Cuprea Bark," but are not used for pharmaceutical purposes, but only for the manufacture of the alkaloids. They are, therefore, of little or no importance to the pharmacist and need not be described.

GROUP XLI

In barks of this group the bast wedges and medullary rays alternate more or less regularly, as shown in the accompanying diagrammatic illustration. As the cells of the medullary rays (fundamental tissue) usually contain starch, they are, therefore, lighter colored than the bast portions, so that this radial striation

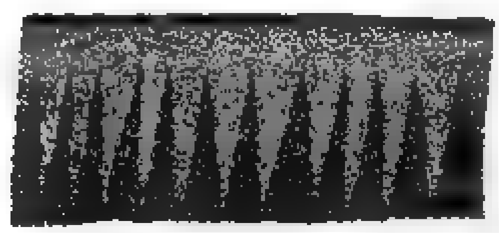


Fig. 245.

can readily be seen with a low magnifying power, or even with the unaided eye. A transverse section should be made and examined with a higher power, so that the cellular elements of the bark can be studied, some of which may be characteristic and diagnostic. But for simply identifying the barks a clean smooth transverse cut is sufficient.

Thin, papery, compound quills, without cork, externally and internally pale cinnamon-colored; pungently aromatic ....**Cinnamom. Zeyl.**

Troughs or simple quills, without cork, both surfaces cinnamon-brown; pungently aromatic..................**Cinnamom. Cassia.**

Large troughs or quills, externally grayish-brown cork, internally cinnamon-brown; pungently aromatic.......**Cinnamom. Saig.**

Quills or irregular pieces, dull brownish, with peculiar transverse cracks and with white lichens with black spots on outer surface; taste bitter aromatic........**Cascarilla.**

Irregularly curved pieces of various sizes, cork removed, both surfaces reddish-brown with a shade of carmine; longitudinally striate, fracture short and pale pink or whitish; bitter astringent........................**Cornus Florida.**

Quills or broken pieces, externally whitish or pale reddish with white scars, internally whitish; odor cinnamon-like and taste pungently bitterish...................**Canella.**

Irregular pieces, outer surfaces often marbled, fragile, soft rust-brown, with characteristic taste and odor...**Sassafras.**

Quills or flat pieces, externally purplish-brown showing small transverse scars, or rough; internally longitudinally fissured; developing bitter almond taste on chewing .... **Prunus Virg.**

Long, coarsely fibrous, pale yellowish-brown pieces, often partially broken and folded upon themselves; bitter.. **Simaruba.**

Quills or troughs, externally dark brownish-gray with corky warts, internally orange-brown with narrow short longitudinal ridges; bitter astringent.......... **Alnus Rubra.**

Shallow troughs and irregular fragments, cork removed, toughly fibrous internally; both surfaces yellowish-brown .... **Magnolia.**

Troughs or quills, purplish-brown externally, internally yellowish-white, fibrous in inner layer; bitter astringent .... **Liriodendron.**

Thin, tough, flexible bands, flattish or quilled, outer surface blackish, inner pale brown; mixed with small roots .... **Rubus.**

Thin fragments, outer surface brownish, inner surface yellow; bitter, stains saliva yellow.................... **Berberis.**

Irregular pieces, outer surface pale yellowish-brown with lighter spots, inner surface smooth and brownish-yellow; fracture abrupt, almost waxy.............. **Ptelea.**

Quills or troughs, brownish-gray with whitish patches, marked with minute black dots and small spines; striation rather obscure........................... **Xanthoxylum, N.**

Cinnamomum

There are three varieties of cinnamon in common use and as they differ materially in appearance, all three will be separately described.

N. Cinnamomum Cassia, Cassia Cinnamon or Cassia, Chinese

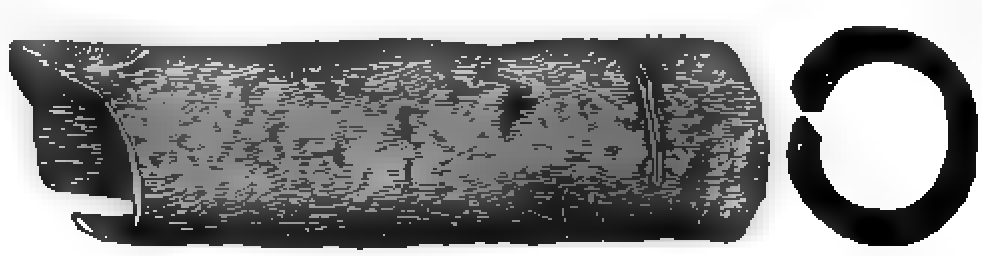


Fig. 246.

Cinnamon.—**O.** The bark of the shoots of one or more undetermined species of *Cinnamomum; Lauraceæ.*—**H.** This variety is a native of China.—**D.** In single and simple quills of various lengths

of the size shown in the left-hand figure; the bark is from 1 to 2 mm. or more in thickness; the corky layer has been removed by scraping, leaving the outer surface somewhat rough; both surfaces are characteristically brown (cinnamon-colored); the fracture is abrupt, nearly smooth and the transverse section shows transverse striation distinctly, as well as many stone-cells (the so-called "stellate" cells of cinnamon) in the middle bark which forms the outer layer of the drug.

N. Cinnamomum Zeylanicum, Ceylon Cinnamon.—**O.** The inner-bark from the shoots of pollarded trees; *Cinnamomum Zeylanicum; Lauraceæ.*—**H.** Ceylon.—**D.** This variety occurs in long quills consisting of several pieces rolled together, with ends

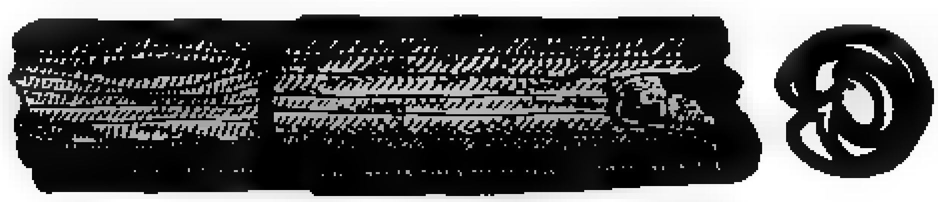


Fig. 247.

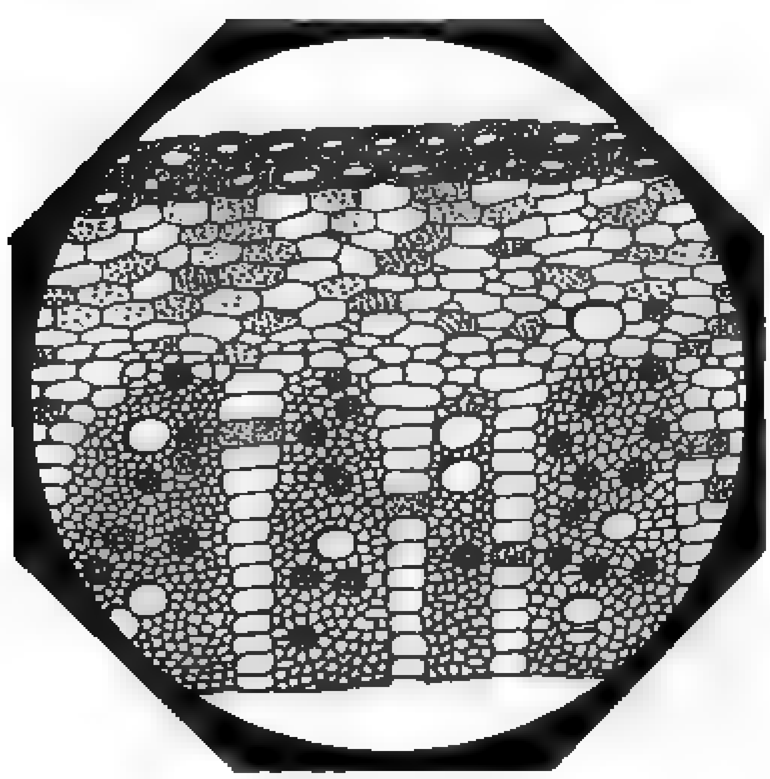


Fig. 248.

stuck into each other so that the total length is about a meter; each compound quill has six or more barks of a thickness not much exceeding that of ordinary wrapping paper; the outer surface of the bark is marked with wavy lines of bast bundles, and

both surfaces are pale-yellowish-brown; both surfaces are smooth and the fracture is short and somewhat splintery.

The coarse appearance of this variety of cinnamon is shown in the right-hand figure above, and an enlarged appearance of a prepared transverse section is shown here; the outer layer, or middle bark of this variety also contains many stone-cells, enough in fact, to constitute a continuous layer; the large white cells in the bast portion of the bark are mucilage cells, and the small darker round cells are bast-cells; before clearing the section numerous oil-cells may be seen, but as these do not differ in size or otherwise from the ordinary parenchyma cells, they cannot be distinguished in a cleared section.

N. Cinnamomum Saigonicum, Saigon Cinnamon.—**O.** The whole bark of an undetermined species of ***Cinnamomum; Lauraceæ.***—

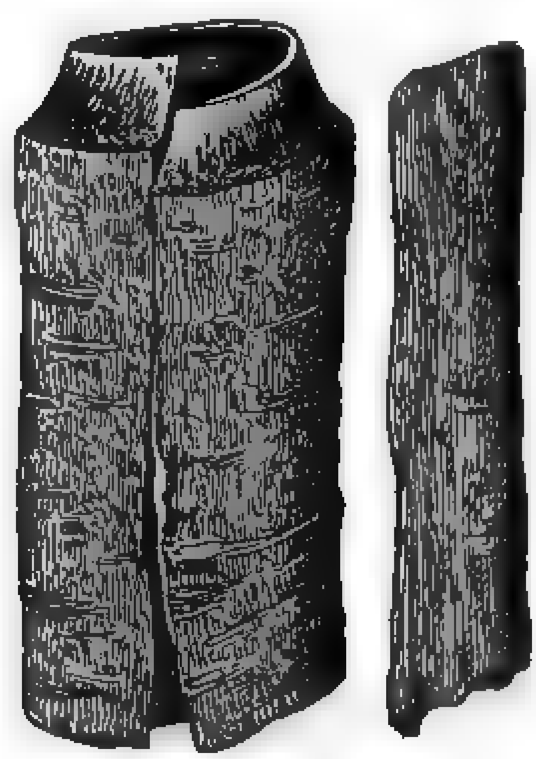


Fig. 249.

H. China.—**D.** In quills of various widely differing sizes, as seen in the drawings, which are natural size; the average thickness of the quills is about 10 to 15 mm., but sometimes more than twice that thickness; the drawings of sections of two pieces of bark, also natural size, show the variation in the thickness of the individual pieces of bark; in this variety the cork is present, the outer surface being gray or light grayish-brown with whitish patches, more or less rough and warty, the inner surface granu-

lar, slightly striate and dark-brown; the ends of the pieces of drug show a shortening of the outer parts due to shrinking in the freshly broken pieces; fracture in the drug is abrupt, showing a large number of yellowish-white cell clusters near the outer part, just within the cork.

All the cinnamon barks have a peculiar, very pleasant fragrant odor and a sweetish, warm and aromatic taste. Ceylon cinnamon has both a finer and stronger aroma than Cassia cinnamon, the latter drug being the least valuable variety of cinnamon. Saigon cinnamon, however, has both the strongest and best aroma, and is the variety that should be preferred for medicinal purposes.—**C.** Volatile oil, some cinnamic acid, sugar, etc.—**U.** Mainly for culinary purposes. It was formerly supposed to con-

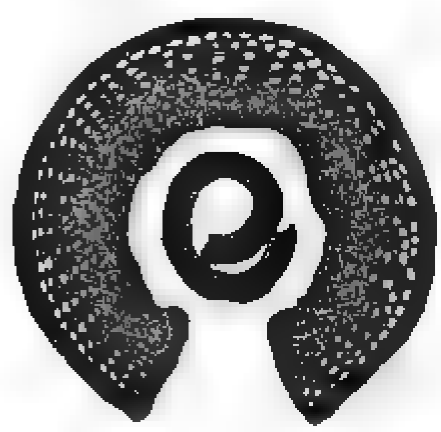


Fig. 250.

trol uterine hemorrhages, but as it was always combined with other more active remedies, it is doubtful whether it itself had any such action. Dose: 1 to 2 grams, or ad libitum.

Cascarilla

N. Cascarilla.—**O.** The bark of *Croton Eluteria; Euphorbiaceæ.*—**H.** The Bahamas.—**D.** The drug consists of quills or troughs, from 2.5 to 10 cm. long and about 10 to 15 mm. thick, or broken into smaller pieces; the bark itself is about 2 mm. thick; the cascarilla imported into the United States consists mainly of young bark which has a dull brown color, both on the outer and inner surfaces; the outer surface is usually much fissured transversely and partly or entirely covered with a white lichenous growth with black spots; the inner surface is smooth; the fracture is abrupt, resinous, and shows distinctly the transverse

striation of the bast bundles and medullary rays; among the parenchyma cells of the bark which contain starch there are scattered numerous brown oil or resin-cells; bast fibers are few; odor is slightly aromatic, but on burning becomes strongly fragrant; the taste is strongly bitter and aromatic.—**C.** About 1.5 per cent volatile oil, cascarillin (a bitter neutral principle), and

Fig. 251.

about 15 per cent of resin.—**U.** Stimulant stomachic. Occasionally used as an ingredient of incense. It is also often used, either alone or in combination with other substances, as a tobacco flavor. Dose: About 2 grams.

Cornus

N. Dogwood Bark.—**O.** The inner bark of the root of *Cornus florida; Cornaceæ.*—**H.** North America.—**D.** In irregularly curved pieces or troughs from which the coarse gray layer has been removed; about 2 to 3 mm. thick; both outer and inner surfaces striated and reddish or reddish-brown, with often a decided tint of rose color or crimson; the fracture, longitudinal and

transverse, is abrupt, showing yellowish clusters of stone-cells; a prepared transverse section has numerous radiating lines of medullary rays, the clusters of stone-cells being irregularly dispersed in the parenchyma of the phloëm, and frequently adhering portions of "bork" show tangential lines of secondary suber or cork; the taste is bitter and astringent, odor none.—**C.** Cornin (or cornic acid), tannin, etc.—**U.** Astringent bitter tonic; slightly febrifuge. Dose: 1 to 5 grams, best in fluid extract.

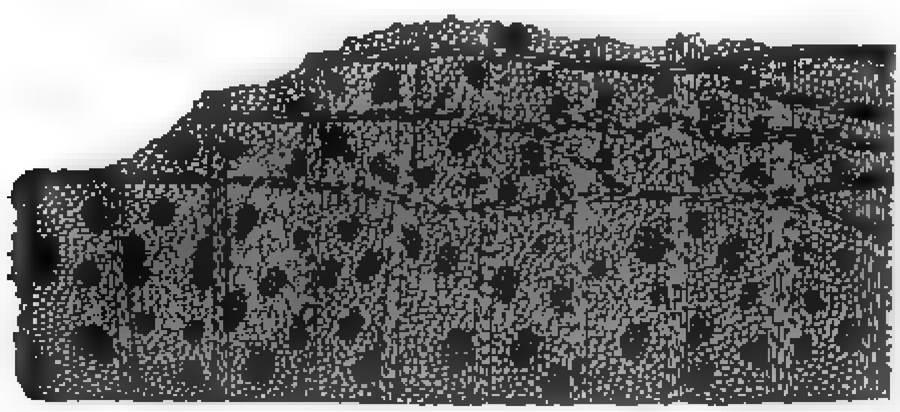


Fig. 252.

The barks of *Cornus sericea* (Swamp Dogwood) and *Cornus circinata* (round-leaved Dogwood) resemble dogwood bark, but are thinner and usually quilled; they are of little importance, as they are very seldom used medicinally.

Canella

N. Canella.—**O.** The bark of the stem of *Canella alba; Canellaceæ.*—**H.** Bahama Islands and West Indies.—**D.** Hard, white quills, troughs, or irregular fragments, about 2 to 4 mm. thick; the outer surface is freed from the outer bark, and is pale brownish-red or brownish-yellow, smooth except that it is marked with long, white, oval scars; barks from older branches are rough on the outside, but constitute only a small proportion of the drug; the inner surface is white, smooth and finely striate; it breaks with an even granular white fracture, showing numerous yellowish resin-cells in the middle bark; a prepared section shows the middle bark to be bounded outwardly by a layer of cubical, lemon-yellow stone-cells, with a parenchyma consisting mainly of starch-cells with numerous interspersed large, round or oval,

yellow resin-cells, while the inner bark is radiately striated with medullary rays, and shows bast fibers; the odor is spicy, resembling cassia (it is called "white cinnamon" in German) and the taste is bitter and pungently aromatic.—**C.** Contains about 1 per cent volatile oil and about 20 per cent of acrid aromatic resin.—

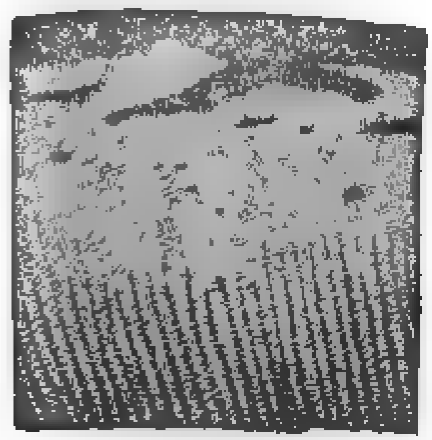


Fig. 253.

U. Stimulant tonic similar in action to other aromatics; used mainly to prevent griping of purgative remedies. Dose: 0.5 to 2.5 grams.

Sassafras

N. Sassafras, Sassafras Bark.—**O.** The inner bark of the root of *Sassafras variifolium; Lauraceæ.*—**H.** North America, especially United States.—**D.** In irregular fragments deprived of the corky layer or bork; about 3 mm. thick; the outer surface from which the bork has been removed is sometimes quite prettily marbled or grained in light and dark gray and rust-brown, owing to the different colors of the parenchyma and the secondary suber of the bork, as shown in a drawing of a piece of the drug; the inner surface is smooth and rust-brown; fragile, soft with short corky fracture, not fibrous; a transverse section of the soaked bark examined by reflected light shows no structure, except when the bork is still present, when the outer part of the bark is distinctly striated in a tangential direction by the light-colored bands of secondary suber, and the drug is apt to be mistaken for one belonging to Group 42; in a thin transverse section the radiating lines of the medullary rays are very distinct, especially

if the section is examined while it is immersed in the solution of caustic potassa before the color has all been removed, because it is discharged first from the medullary rays, which then are light-colored among the deep-red parenchyma; the prepared section shows many medullary rays and some bands of secondary suber, and numerous reddish or yellowish oil-cells and isolated pale yellow bast-cells; fragrant, sweetish aromatic.—**C.** About 3 per

Fig. 254.

cent of volatile oil, traces of tannin, etc.—**U.** Sassafras is popularly much esteemed as a "blood purifier," or alterative; it is a stimulant diaphoretic, especially when administered in the form of copious draughts of hot infusion, the hot water no doubt deserving some of the credit for the action. More commonly used merely as a flavoring agent. Dose: Usually ad libitum, of the tea.

Prunus Virginiana

O. Wild Cherry, Wild Cherry Bark.—**N.** The bark of *Prunus serotina (Prunus Virginiana); Rosaceæ.* The drug should be collected in autumn.—**H.** North America, especially United States. **D.** The bark of medium-sized branches should be used, that of the large stems and roots or of small twigs being inferior. Wild

Cherry bark occurs in troughs or irregular pieces of various sizes, but should be at least 2 mm. thick; if from large stems or roots the corky layer is usually removed and the pieces are flat, with the outer surface rough, uneven, only obscurely marked with the peculiar transverse scars (lenticels), and rust-brown; if from medium-sized or small branches the bark is smooth, greenish, yellowish or reddish-brown and marked with numerous elevated, transverse, light-colored, peculiar and characteristic scars or warts (lenticels), the thin cork or epidermis show-


Fig. 255.

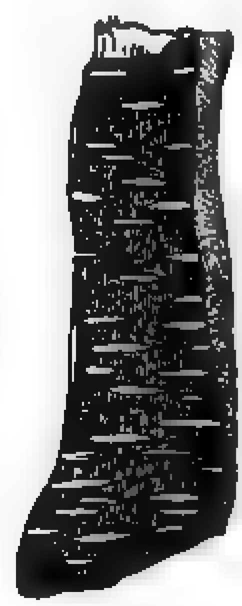


Fig. 256.

ing a strong tendency to peel off and curl up (see Fig. 256); the inner surface is pale cinnamon-colored, striated or more frequently longitudinally fissured, as shown in Fig. 255, showing the inner surface enlarged; the other illustration shows the outer surface, natural size; the drug has little or no odor when dry, but after macerating with water or chewing, it gives a strong bitter almond odor; the taste is bitter and astringent with the aroma of bitter almonds.—**C.** Two principles resembling the amygdalin and emulsin of bitter almonds, but not identical with

them, which react on each other in the presence of water and yield hydrocyanic acid and oil of bitter almonds; a bitter glucoside, tannin, etc.—**U.** Bitter stomachic and tonic, with slight sedative effect, the latter making it a popular remedy for colds and coughs. Dose: 2 to 5 grams, best in form of syrup or fluid extract.

Simaruba

N. Simaruba.—**O.** The bark of the roots of *Simaruba officinalis* and *S. medicinalis; Simarubaceæ.*—**H.** South America and West Indies.—**D.** Flat pieces, troughs or rarely quills, often up to a meter long, folded lengthwise, from 3 to 6 mm. thick; externally rough, wrinkled, with whitish suber, or the latter more generally rubbed off, in which case the outer surface is pale fawn-colored, rough with coarse stone-cells and tough fibers; inner surface lighter-

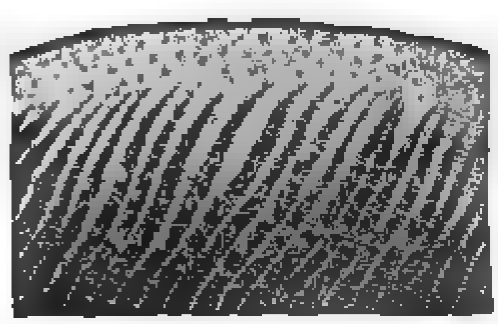


Fig. 257.

colored and striate or fibrous; bast toughly fibrous, arranged in somewhat obliquely radiating lines, separated by rather broad medullary rays, as shown in Fig. 257; the direction of the obliquity may appear to be from left to right, or the reverse, depending on which side of the section comes uppermost when mounting the specimen; odorless and intensely and persistently bitter.—**C.** Volatile oil and resin in very small proportion, a bitter principle (probably quassin), etc.—**U.** A bitter tonic. Often used in diarrhœas and dysenteries, in which diseases it is often of marked value, especially when they are due to an atonic condition of the alimentary tract. Dose: 2 to 5 grams.

Alnus Rubra

N. Tag Alder.—**O.** The bark of *Alnus serrulata; Betulaceæ.*—**H.** North America.—**D.** In quills or troughs, externally dark brownish-gray, marked by corky warts which tend to run together trans-

versely; the inner surface is orange-brown and marked by scattered, coarse, narrow, short, longitudinal ridges, or striate, as shown in the illustration of the inner surface; the drawings of the whole bark are of natural size, that of the section is enlarged 5

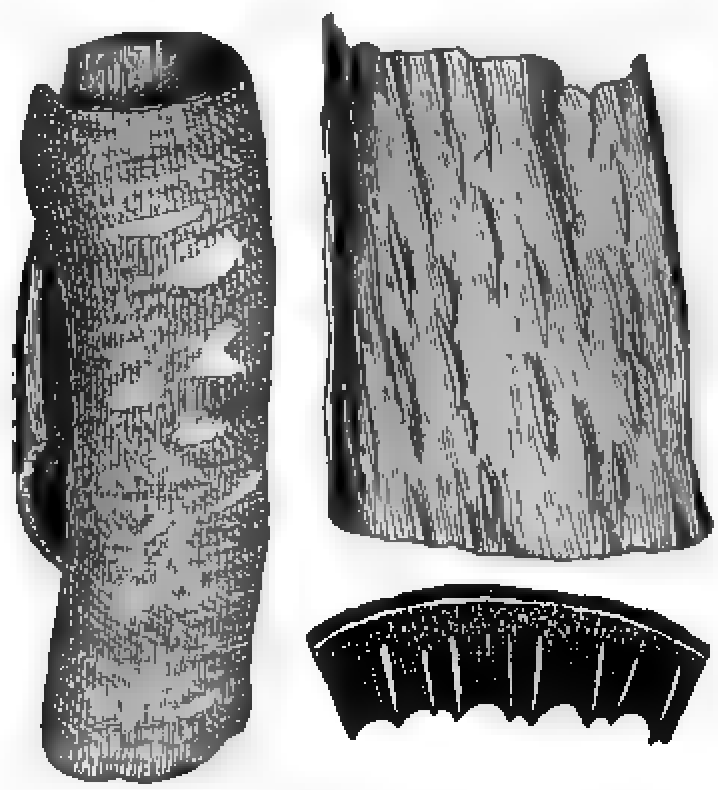


Fig. 258.

times; odor feeble, taste bitter and astringent.—**C.** Tannin, etc.; no exact analysis has been made.—**U.** Astringent. Also reputed to be alterative and emetic. Dose: 2 to 5 grams, best given as fluid extract.

Magnolia

N. Magnolia.—**O.** The barks of *Magnolia glauca, M. acuminata* and *M. tripetala; Magnoliaceæ.*—**H.** Southern United States.—**D.** The bark from young branches is in quills or troughs, thin, orange-brown and glossy or light gray, with scattered warts or somewhat fissured; internally pale yellowish-white or pale brownish and smooth; fracture abrupt, slightly fibrous in the inner layers; in bark from older branches or stems, the bork, if present, is dark gray and deeply fissured, but as found in the trade the outer layer of the bark is generally removed and the drug consists only of the inner bark, which is often from 5 to 6 mm. thick; both inner and outer surfaces are of a pale yellowish-brown

color, the outer surface appearing to be somewhat granular, while the inner is more fibrous; the illustrations show the transverse sections of ***Magnolia glauca***, that of Fig. 259 being the entire bark with bork, Fig. 260 the inner bark alone as most generally seen in the trade, both showing a smooth cut section examined by reflected light with a Coddington lens; the drug has no odor; the taste is bitter, astringent and pungent.—**C.** Tasteless neutral principle, tannin, resin, etc.; analysis not complete. Judging by the taste, the bark from small twigs is better than that of the

Fig. 259.

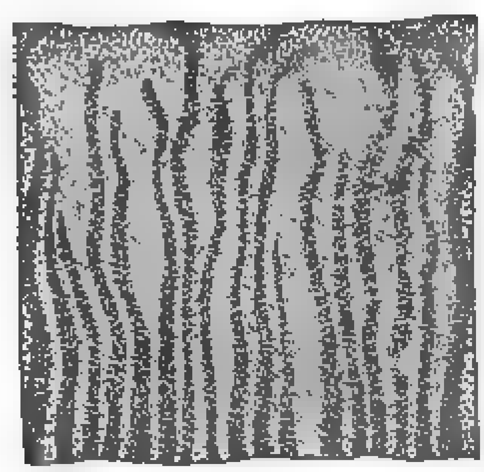


Fig. 260.

larger stems, for it is more pungent and bitter.—**U.** Tonic, febrifuge and diaphoretic. Dose: 2 to 5 grams, in decoction or fluid extract.

Liriodendron

N. Tulip-tree Bark.—**O.** The bark of the branches of *Liriodendron tulipifera; Magnoliaceæ.*—**H.** United States.—**D.** The bark of smaller branches comes in thin quills or troughs, the bark being about 2 mm. thick; the outer surface is grayish or blackish-brown with often a purplish shade, longitudinally wrinkled so that the wrinkles sometimes resemble elongated meshes; internally yellowish-white, smooth, or somewhat fibrous; pieces of bark from larger branches are up to 6 mm. thick, with a deeply fissured bork of a grayish-brown color often with a greenish tint due to lichenoid growths; a smooth transverse cut (Fig. 261) shows nearly one-half of the thickness of the bark to be corky layer, of a light-brown color on section, and the inner part, rather more

than half the thickness, to be pale yellowish or white; the bark of older stems or branches is usually deprived of its corky layer and is white on both outer and inner surfaces; by aid of a lens the inner bark shows fibro-vascular bundles alternating with medullary rays so as to give a plainly radially striated appearance, and the individual bast-bundles appear beaded; this is shown in Fig. 261, showing a section of the bark by reflected

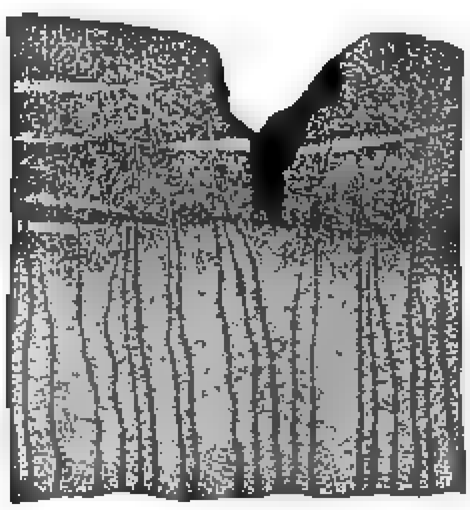


Fig. 261.

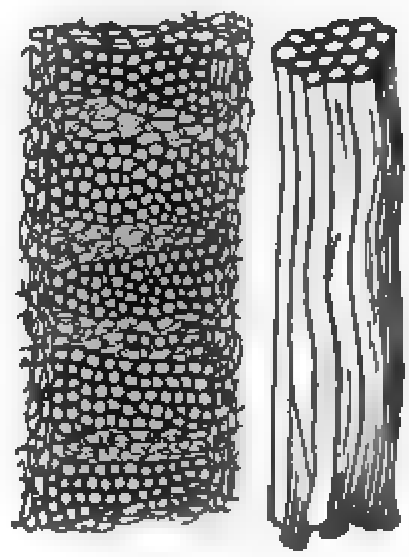


Fig. 262.

light, enlarged; Fig. 262 is a section of a bundle, much enlarged, showing minute structure to which this beaded appearance is due, and a small fragment of one of the bast-bundles is also shown in longitudinal section; no odor, taste bitter and slightly astringent.—**C.** Various resins, a glucoside, tannin, etc.—**U.** Tonic, febrifuge and vermifuge; seldom used. Dose: 5 to 10 grams in infusion or fluid extract.

Rubus

N. Blackberry Root Bark.—**O.** The bark of the roots of *Rubus*

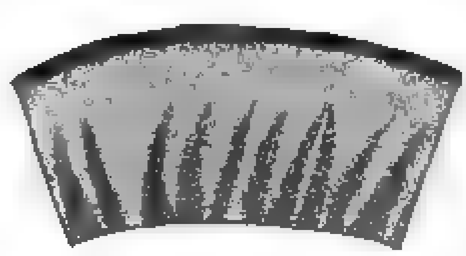


Fig. 263.

villosus (blackberry), *R. Canadensis* (dewberry), and *R. trivialis*; *Rosaceæ*.—**H.** United States.—**D.** Thin, tough, flexible bands,

sometimes flattish, more often quilled; the outer surface blackish or blackish-gray, inner surface pale brown, often with strips of white wood adhering; fracture rather tough and fibrous, whitish; a large proportion of the drug consists of the smaller rootlets entire; a section of the bark shows the bast in rather broad, obliquely radiate wedges, some of which are made up of the bast of two or more bundles; the drug is odorless, with astringent and slightly bitter taste.—**C.** 10 to 12 per cent tannin, the bitter glucoside villosin, etc.—**U.** Astringent tonic. Dose: 5 to 10 grams, best as fluid extract.

Berberis

N. Barberry Bark (must not be confounded with the rhizome and roots of *Berberis Aquifolium*, which is also called "Berberis").—**O.** The bark of *Berberis vulgaris; Berberidaceæ.*—**H.** Europe and Asia; naturalized in America.—**D.** Thin fragments,

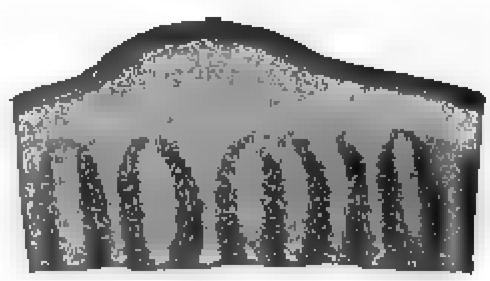


Fig. 264.

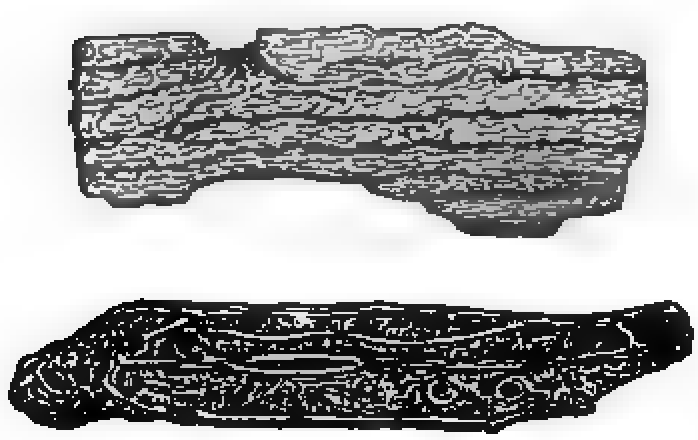


Fig. 265.

outer surface brown or brownish-gray, inner surface yellow, separating in thin shreds or sheets; a clean-cut section of a soaked piece shows an outer dark brown corky layer, a middle bark of light yellow color, abruptly marked off from darker yellow or brownish inner bark, which is plainly radiate with dark brown

or almost black bast-bundles, so arranged that two of them often join in almost O-shape (see Fig. 265). The drug in bulk has a slightly herbaceous odor and a pure, bitter taste, and stains the saliva yellow.—**C.** Alkaloids berberidine and oxyacanthin, etc.—**U.** Bitter tonic and stomachic; in large doses laxative with supposed cholagogue effect. Dose: 2 to 6 or 8 grams.

Ptelea

N. Wafer Ash Bark, Shrubby Trefoil Bark, Hop Tree Bark.—**O.** The bark of *Ptelea trifoliata; Rutaceæ.*—**H.** North America.—**D.** In irregular pieces, troughs or quills of various sizes, the bark itself up to 4 mm. thick; the outer surface pale yellowish-brown

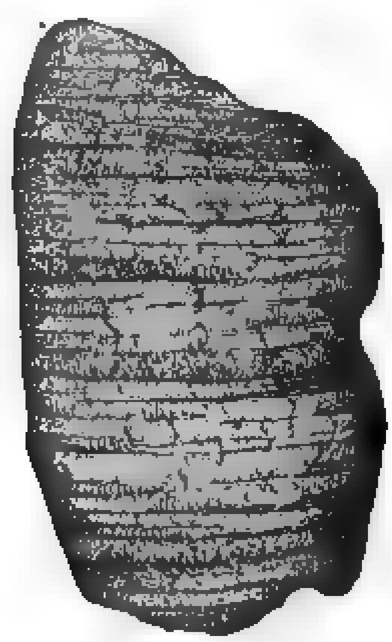


Fig. 266.

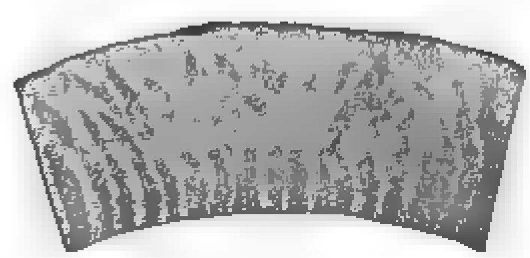


Fig. 267.

with grayish-white markings, with transverse ridges and grooves and occasional transversely elliptical patches or depressions, the inner surface smooth and brownish-yellow; fracture abrupt, cutting with a waxy feel; on smooth cut section the corky layer is not well marked, being of same pale yellowish color as the middle bark, the inner bark is striated with irregularly radiating bast-bundles of a slightly darker color than the parenchyma of the middle bark and the medullary rays; faint, not characteristic odor, and a mucilaginous, slightly acrid and bitter taste.—**C.** No analysis.—**U.** Stomachic tonic. Dose: 0.5 to 2 grams, best in fluid extract.

Northern Prickly Ash Bark, the bark of *Xanthoxylum Ameri-*

canum, shows radiating striation of bast, but as the Southern Prickly Ash Bark has no well marked striation, and it is not very plain even in the Northern variety, this bark will be more fully described under Group XLV.

GROUP XLII

The barks of this group show on a smooth-cut transverse section, especially if moistened with diluted liquor potassa, either continuous or interrupted rows which are at right angles to the medullary rays, or parallel with the corky layer, giving the appearance as in the diagrammatic illustration; the medullary rays are not well marked, although traces of them can be seen, and in some instances even quite plainly, but when the medullary rays make quite distinct radial lines the bark would belong in

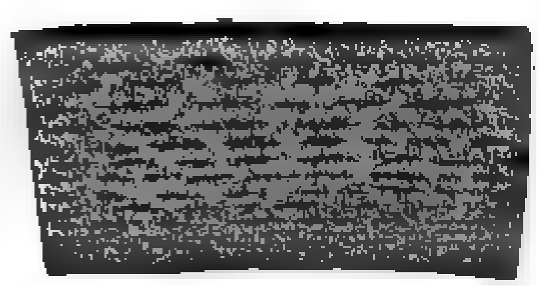


Fig. 268.

the next group; thus the stem bark of Juglans, which generally shows only the tangential lines distinctly, in some pieces shows quadratically striated, although the checkered appearance is very plain in the root bark. Nearly all barks show their characteristic markings when a piece is freshly broken across, then cut smooth with a sharp knife and examined with a Coddington lens, but some barks require soaking before cutting, and sometimes even moistening with dilute solution of potassa to increase the contrast in color between the medullary and bast rays. It is advisable, also, to cut as thin a section as possible from the end of a piece of bark previously soaked in water or diluted alcohol, place this section in a drop of liquor potassa on a slide and cover with a cover glass, and examine, while clearing, with a lens of rather low power; the markings often appear plainer while clearing, than when the section has been completely cleared. Making such a slide need not take more than one or two minutes of time.

Nearly flat massive bark, with thick corky layer deeply fissured; gray or grayish-brown on outer and yellowish-red on inner surfaces............**Aspidosperma.**

Thin flexible bands or quilled pieces; brownish on outer and whitish on inner surfaces; separable into thin layers..............................**Gossypii Radicis Cortex.**

Long, thin flexible bands, rolled into bundles, yellowish on outer and silky-white on inner surfaces ....**Mezereum.**

Quilled pieces or troughs; ash-gray outer and whitish or pale tawny inner surfaces..............**Euonymus.**

Flattish pieces or troughs; ash-gray outer and pale brown or whitish inner surfaces...............**Viburnum Opulus.**

Thin quills or troughs, gray-brown outer and pale brown and striated inner surfaces.............**Cundurango.**

Coarse quills, troughs or irregular pieces, toughly fibrous; outer surface gray or blackish-brown with many transverse ridges, inner surface smooth or fibrous..............................**Piscidia.**

Thick quills or troughs with coarsely fissured grayish-brown corky layer, or without bork; yellowish-brown and striated inner surface......**Alstonia Constricta.**

Small contorted quills or troughs, usually irregularly broken; occasionally whole pieces of root; their brownish corky layer usually partially detached and adherent in shreds......................**Rhois Glabræ Cort.**

Large troughs or flat pieces, smooth, dark-brown and mottled on outer surface; bork generally absent ....**Juglans (stem).**

Aspidosperma

N. Quebracho, Quebracho-blanco, White Quebracho.—**O.** The bark of *Aspidosperma Quebracho-blanco; Apocynaceæ.*—**H.** Brazil and Argentine Republic.—**D.** Large pieces slightly curved or nearly flat, from 1 to 3 cm. thick, the rough bork and the inner bark being of about equal thickness. The corky portion of the bark is deeply fissured, both longitudinally and transversely, the fissures being quite wide and of grayish color from lichenous growths, while the elevated parts of bark are grayish-brown to rust-brown. On section the corky layer is yellowish-brown to rust-brown, with dark tangential lines of secondary suber and rows of whitish clusters of sclerenchyma cells showing that the outer layer is bork. The inner bark is fawn-colored and marked

with fine longitudinal lines on the inner surface, which is otherwise nearly smooth; on section the inner bark shows numerous whitish groups of sclerenchyma cells arranged in tangential rows. The fracture is fibrous, irregular. No odor and taste intensely bitter.—**C.** Six alkaloids, of which aspidospermine and

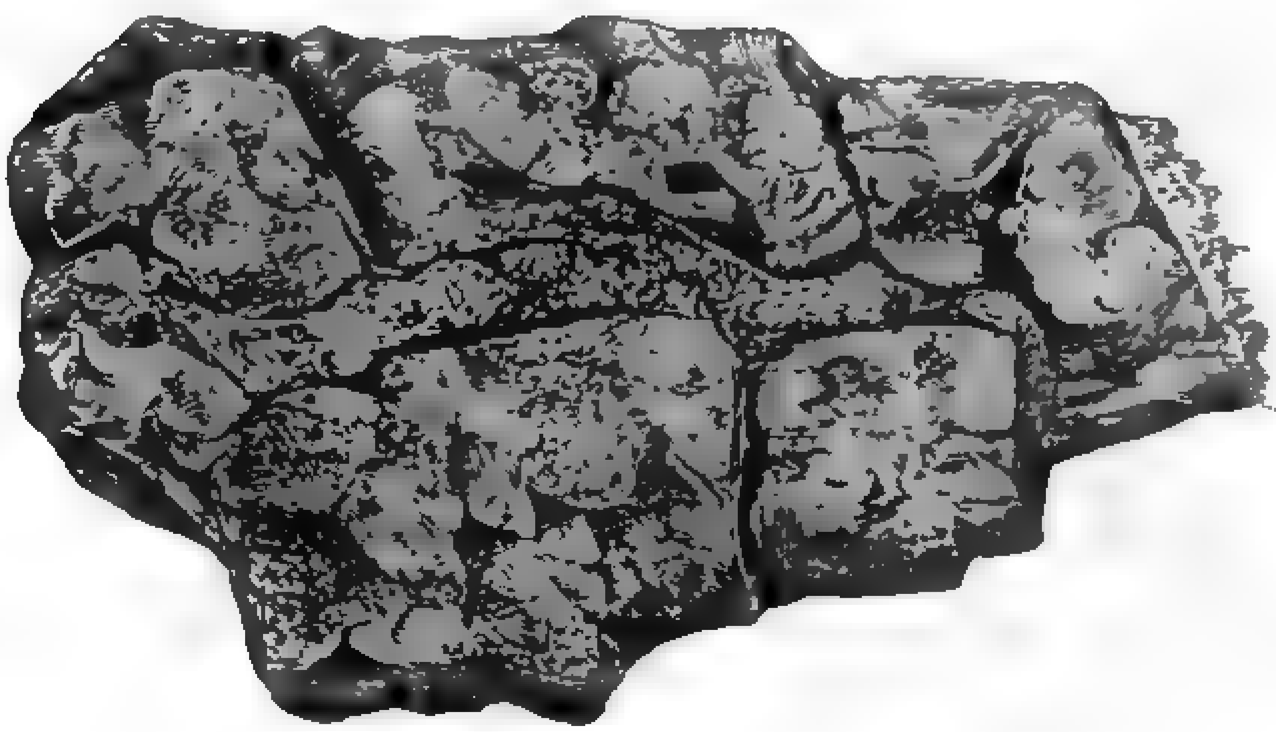


Fig. 269.

Fig. 270.

quebrachine are the most important.—**U.** Used to relieve dyspnea, from whatever cause it may arise. Tonic and antispasmodic in asthma. Dose: 1 to 5 grams. Fig. 269 shows the whole bark.

False Quebracho.—The bark shown in Fig. 270 is sometimes

found in trade as a substitute for true quebracho. It is Quebracho Colorado, dark quebracho or false quebracho, obtained from *Loxopterygium Lorentzii; Anacardiaceæ.* It is heavy, outer surface dark brown and fissured, light brown on inner surface, which is marked by a great number of prominent longitudinal ridges. It is about 12 mm. thick. The transverse section appears tangentially striated from secondary suber and rows of bast-cells, and sometimes the light-colored medullary rays are distinct enough to give a quadratically checkered appearance. In the specimen I have seen, the fissures in the bork contained many tangled fibers, probably the rootlets of some climbers. Odorless, taste slightly resinous and astringent, not bitter. Valueless.

Gossypii Radicis Cortex

N. Cotton Root Bark.—**O.** The bark of the root of *Gossypium herbaceum; Malvaceæ.*—**H.** The cotton plant is indigenous to sub-

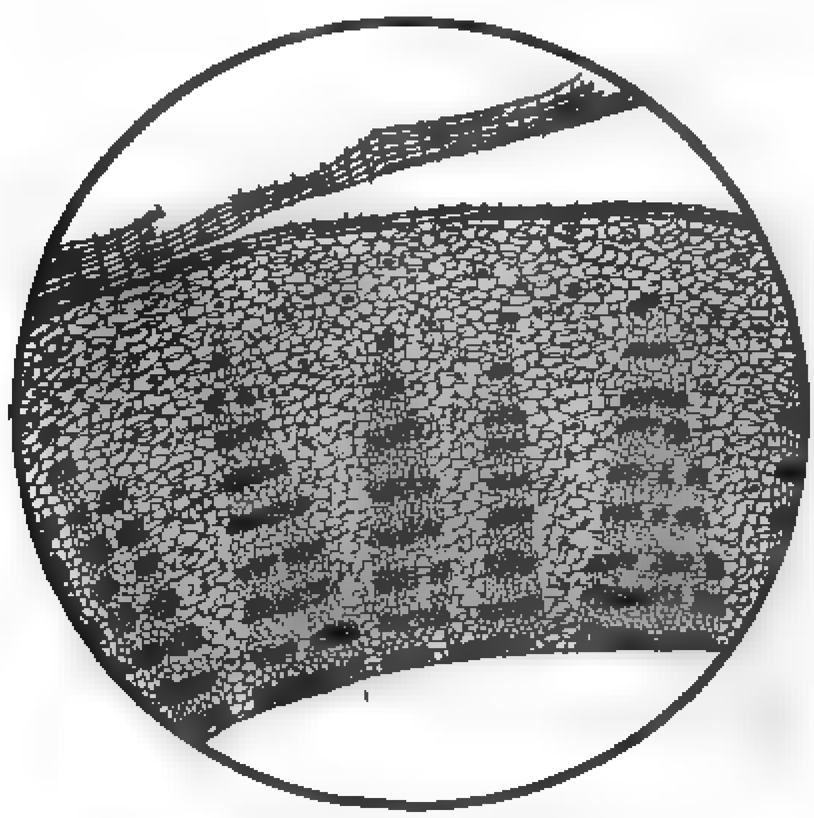


Fig. 271.

tropical Asia and Africa and is cultivated in America. The drug is gathered in the United States, south of the Ohio River.—**D.** The drug consists of thin, flexible, flat or quilled bands; the outer surface is brownish-yellow, with slight longitudinal ridges or

meshes, sparsely scattered small, round, black dots, or short transverse lines, and dull orange-brownish patches where the thin outer bark is abraded; the inner surface is tawny or whitish, finely striate and of silky luster; quite a large proportion of the drug consists of the smaller roots entire. The transverse section (Fig. 271) shows the bast-fibers in clusters forming tangential lines; these bast-fibers are long and tough and the bast can be separated into thin shreds or layers; no odor; taste very slightly acrid and faintly astringent.—**C.** Resin, fixed oil, tannin and a deep red coloring matter.—**U.** Employed as an emmenagogue. It acts on the uterus similarly to ergot, and is used in cases of suppressed or scanty menstruation. In large doses it may produce abortion, and in fact is often administered with the intention of bringing about this effect. Dose: 2 to 5 grams, best as fluid extract.

Mezereum

N. Mezereum, Mezereon Bark.—**O.** The bark of *Daphne Mezereum, D. Gnidium and D. Laureola; Thymelaceæ.*—**H.** Northern Europe and Asia, also Canada and New England.—**D.** Mezereum occurs in long thin bands, very flexible and tough, usually rolled into discs or bundles; the outer surface consists of reddish-brown cork, which is easily separable in shreds, showing the greenish

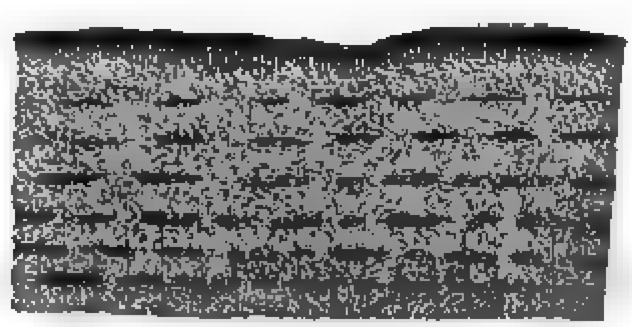


Fig. 272.

middle bark underneath; the cork is marked with many round or slightly transverse scars which are dark-colored, but often abraded and then yellowish-brown and lighter-colored than the cork; the inner surface of the bark is whitish and silky fibrous; on transverse section the cork and thin middle bark usually tear, the inner bark or bast separating from them; in the latter the bast-bundles are arranged in somewhat irregular and interrupted

tangential lines, as indicated in the illustration; the bast-cells are very long and tough; the drug has no odor, but a very acrid taste, and the powder is an extremely irritating sternutatory.—**C.** A soft, brown, acrid resin, an acrid volatile oil, the glucoside daphnin, etc.—**U.** Mezereum is esteemed as an alterative stimulant in chronic syphilitic, scrofulous, rheumatic and cutaneous affections; generally in combination with sarsaparilla and other so-called blood purifiers. Dose: 0.5 to 1 gram, best as fluid extract.

Euonymus

N. Wahoo.—**O.** The bark of the root of *Euonymus atropurpureus; Celastraceæ.*—**H.** United States.—**D.** Quills or troughs and irregular pieces, the bark itself being about 2 mm. thick; the outer surface is gray, with dark ridges or patches; the inner surface is

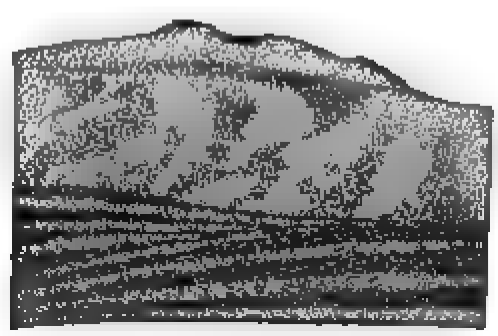


Fig. 273.

whitish or tawny, and smooth; the fracture is abrupt through the outer part of the bark, but the bast is slightly fibrous from silky fibers, which are quite delicate and not at all tough; the smooth-cut transverse surface is whitish and mottled with brown, with tangential brownish lines in the inner bark, as shown in Fig. 273; the odor is faint, taste sweetish-bitter and acrid.—**C.** A bitter amorphous substance called euonymin, extractive, etc. The "euonymin" of trade is merely a powdered extract.—**U.** Said to be tonic, laxative, alterative, diuretic and expectorant. Dose: 1 to 5 grams.

A bark occurs in the trade under the name of "**Southern Wahoo,**" which comes in chips evidently removed from the branches by knives, so that it has thin edges; small, thin troughs bent longitudinally outwardly, occasionally with bits of wood adhering; grayish-brown, lighter-colored on inner surface, wood whitish;

corky layer reticulately or longitudinally wrinkled, with occasional small warts; the transverse smooth-cut section shows numerous clusters of sclerenchymatous cells arranged in irregularly tangential rows. This bark may be the bark of *Ulmus alata* (winged elm) which is called "wahoo" in the Southern part of the United States, although the statement of the National Dispensatory that this bark is used to make ropes does not agree with the brittle and abrupt fracture of the bark under consideration. At all events, it is not the "wahoo" of the Pharmacopoeia, and should not be used as "wahoo."

Viburnum Opulus

N. Cramp Bark.—**O.** The bark of *Viburnum opulus; Caprifoliaceæ.*—**H.** Northern temperate zone, in America, Europe and Asia.—**D.** In quills or troughs, 10 to 25 cm. long, the bark itself

Fig. 274.

being about 1 to 2 mm. thick; the outer layer is greenish or brownish-gray but peels off easily and shows the reddish-brown inner bark underneath; the inner surface is grayish or slightly brownish; fracture of young bark brittle, of older pieces tough, the bast separating into layers; on transverse section (upper

drawing of Fig. 274) the bast is seen to be tangentially striated with rows of almost rectangular clusters of cells which are dark by reflected light, but transparent in thin sections by transmitted light; the drug is inodorous, with pungent and bitter taste Fig. 274 shows both old and young barks entire, and a smooth-cut section by reflected light.—**C.** A bitter principle, pungent resin, etc.—**U.** Antispasmodic, useful especially in uterine colic, cramps in hysterical women, etc. Dose: 1 to 5 grams in infusion or in fluid extract.

Condurango

N. Condurango.—**O.** The bark of *Gonolobus Cundurango; Asclepiadaceæ.*—**H.** Ecuador and Peru. Said to be often mixed with the barks of other varieties of Asclepiadaceæ, etc.—**D.** In quills and troughs about 5 to 10 cm. long, the bark itself from 2 to 6

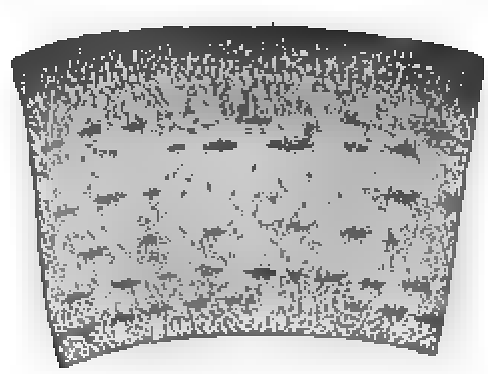


Fig. 275.

mm. thick; the outer surface is grayish-brown, with here and there remains of silvery gray epidermis, and occasional whitish or ash-gray patches of lichens, and with occasional small, black lichenous dots; the corky layer with shorter or longer transverse ridges or warts, but more commonly longitudinally wrinkled and fissured; the cork chips off in places, showing the tawny middle bark underneath; the inner surface is lighter-colored, tawny or yellowish-white, and longitudinally striated with elevated lines, and occasionally irregularly dotted with dirty grayish-brown spots; the fracture is granular, with a few projecting fibers nearer the outer surface; a smooth-cut section, especially of a soaked piece, shows as in Fig. 275, the outer part brownish, gradually shading to grayish-white within, and showing compara-

tively large and few clusters of stone-cells arranged in more or less well-marked tangential rows; the parenchyma contains starch and crystals of oxalate of calcium. Nearly odorless and but faintly bitter. **C.** A peculiar glucoside, some tannin, etc.—**U.** When first introduced it was heralded to be a sure cure for cancer, but unfortunately it has proved worthless as a remedy for this disease. It has probably merely slightly tonic effects and is medicinally of very inferior value. Dose: About 2 grams.

Rhois Glabræ Cortex

N. Sumach Bark.—**O.** The bark of *Rhus glabra; Anacardiaceæ.* The root bark is preferred.—**H.** North America.—**D.** Quills or

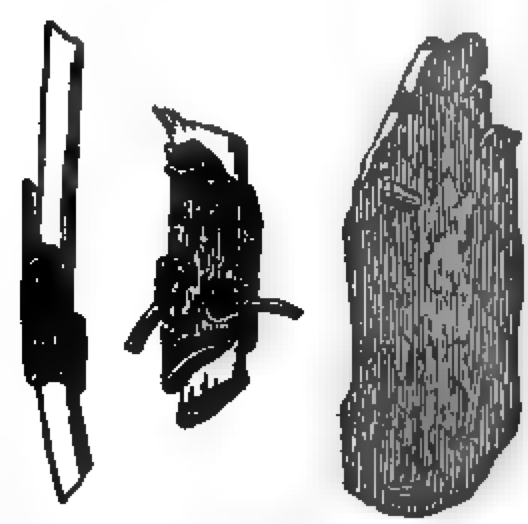


Fig. 276.

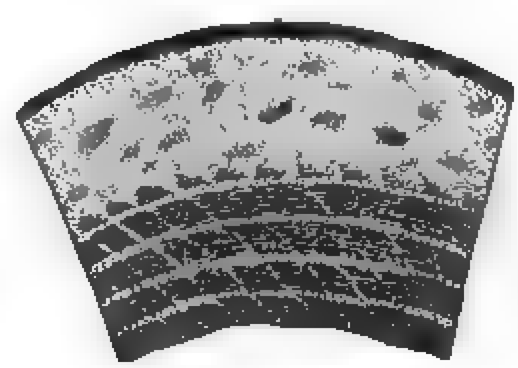


Fig. 277.

troughs, or irregular somewhat twisted or contorted fragments, sometimes enclosing pieces of wood; the corky layer, which often hangs in shreds, is chocolate-brown with scattered reddish-brown warts; the middle bark appears yellowish-gray wherever the corky layer is abraded; the inner surface is smooth and of a light cinnamon-brown color; fracture abrupt and grayish-white, the smooth-cut section showing by reflected light the structure shown in Fig. 277, the corky layer thin, the middle bark rather thick, light yellowish-white with yellowish-brown spots, and the inner bark with distinct tangential alternating brownish and whitish lines; odor none, taste bitter astringent.—**C.** Tannin, etc.—**U.** Astringent tonic, useful for both internal and local use. Dose: 2 to 5 grams.

Juglans

N. Butternut Bark.—**O.** The bark of *Juglans cinerea; Juglandaceæ.* The inner bark of the root should be preferred, but bark of the stem also is found in the trade; usually the two barks are

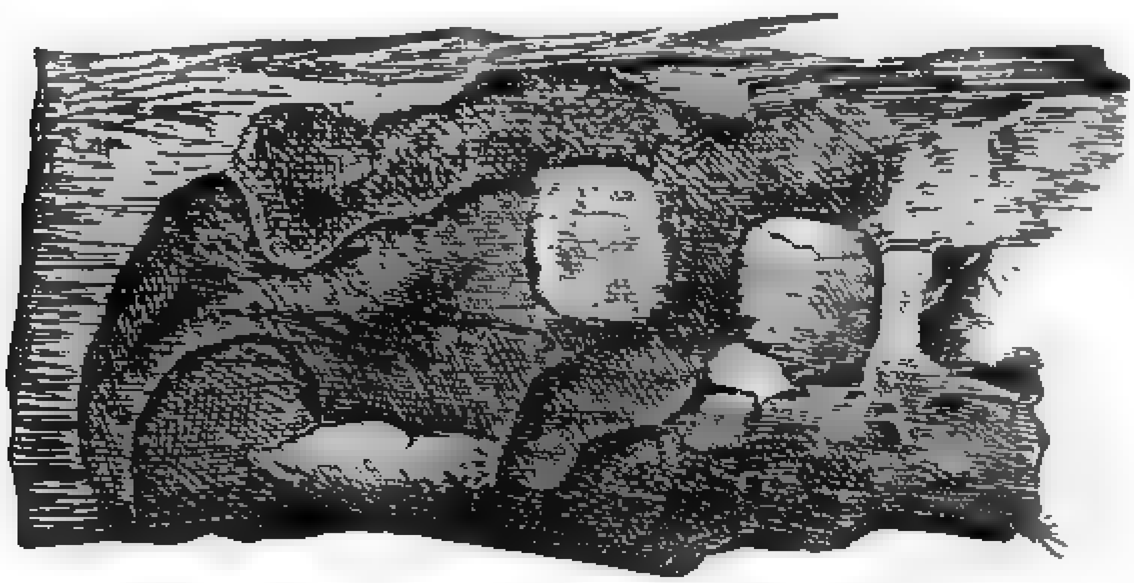


Fig. 278.

sold separately. The bark should be collected in autumn.—**H.** North America.—**D.** In flat, coarsely fibrous pieces or troughs, up to 20 cm. long and from 3 to 5 mm. thick, but occasional pieces

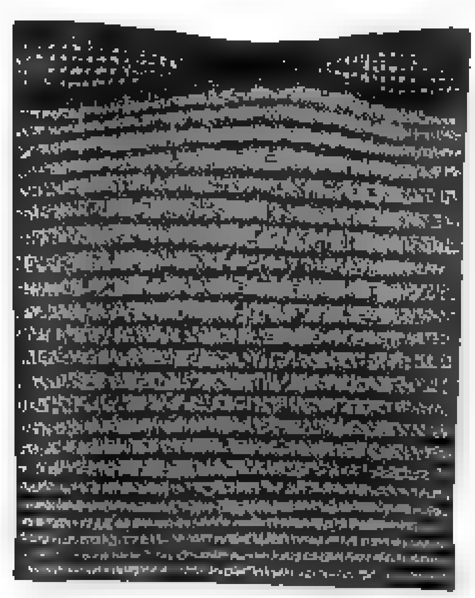


Fig. 279

with bork may be much thicker; the drug is usually deprived of all bork and is grayish-brown, mottled with darker colored markings and lighter colored patches, as shown in Fig. 278; the inner surface is dark-brown, smooth or striate and fibrous, but the fibers

are not tough, so that the fracture is short and cutting with a knife shows all parts to be quite soft; a smooth-cut section of a thick piece (about 6 mm.) is shown in Fig. 279, with a bit of bork (secondary cork and sphacelated inner bark) attached, and the balance of thickness is made up of alternate layers of parenchyma and rows of bast-cells which form practically continuous lines; in a section of thinner pieces the outer portion is middle bark of a light-brown color and the inner bark, somewhat abruptly marked off from the middle bark, shows the characteristic tangential lines; occasionally in the smooth-cut end it is possible to find checkered or quadratically marked parts, but this usually requires a finished section, which has been cleared and is examined by transmitted light, when it appears almost always checkered, and would be referred to Group XLIII; odor faint and taste slightly acrid and bitter.—**C.** Nucin (juglandic acid), 14 per cent of fixed oil, a little tannin, etc.—**U.** Laxative and tonic. Dose: 5 to 10 grams, best in infusion or fluid extract.

Piscidia

N. Jamaica Dogwood Bark.—**O.** The bark of *Piscidia Erythrina; Leguminosæ.*—**H.** West Indies.—**D.** In coarse quills or troughs, or irregular pieces, about 15 to 20 cm. long, very fibrous and torn, the bark itself being from 4 to 6 mm. thick; the outer surface is marked with transverse ridges or warts, the edges of which are

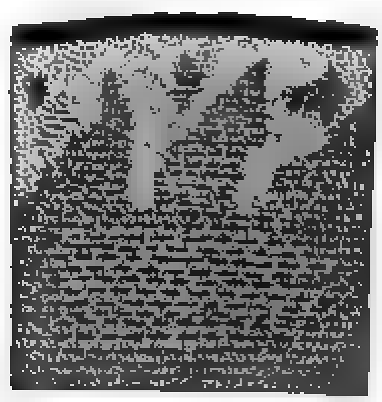


Fig. 280.

somewhat raised so that they look like oval or elongated grooves with elevated margins; the corky layer, when present, is of chocolate-brown color with orange-brown spots, but more commonly the corky layer is absent; where the corky layer is broken away

the surface appears brownish-gray, with the wrinkles or warts showing distinctly; the inner surface is of a dirty-gray color, longitudinally fissured, smooth or fibrous; the fracture is very tough and fibrous, the freshly-broken surfaces appearing yellowish-white; a smooth-cut transverse section shows the bast-bundles in short tangentially elongated clusters, closely packed in such a manner as to give a somewhat irregularly serrate demarkation between the inner and middle barks; Fig. 280 shows a section seen by reflected light, when the middle bark appears yellowish-white and the inner bark brownish; the odor is very faint, sometimes described as narcotic or opium-like, and the taste is slightly bitter.—**C.** Resin, a neutral principle piscidin and a bitter glucoside.—**U.** Soporific, narcotic, anodyne and sudorific. Dose: 1 to 3 grams.

Alstonia Constricta

N. Australian Fever Bark.—**O.** The bark of *Alstonia constricta; Apocynaceæ.*—**H.** Australia.—**D.** In quills or troughs of various lengths, usually about 15 to 20 cm. long, the bark itself being up to 6 mm. thick; the outer surface usually is covered with a rough,

Fig. 281.

fissured, spongy and friable corky layer, which is grayish-brown with ash-gray patches or occasionally almost the entire surface is whitish-gray; sometimes the corky layer is covered with lichens and in a small proportion of the pieces it is altogether wanting; the inner surface is superficially dark brown, often splintery or coarsely fibrous and torn, showing light orange-brown in the

interior parts of the bark; the fracture is fibrous and splintery; a smooth-cut transverse section of a piece previously soaked in water is, as in Fig. 281, with rather dark-brown mottled cork, bright-yellow middle bark and the inner bark with numerous dark-colored short tangentially stretched clusters arranged in longer tangential rows; odor faint and taste intensely bitter.—**C.** Bitter taste is probably due to an alkaloid, alstonine.—**U.** Used for similar purposes as Cinchona, as a bitter tonic and anti-periodic. Dose: 5 to 10 grams, best in fluid extract.

A Similar Drug is **Dita Bark**, the bark of *Alstonia scholaris; Apocynaceæ.* This drug is obtained in the Philippine Islands. In thick troughs or partial quills of various lengths from 5 to 20 cm. long (Fig. 282); the corky layer is rough, fissured, leather-brown,

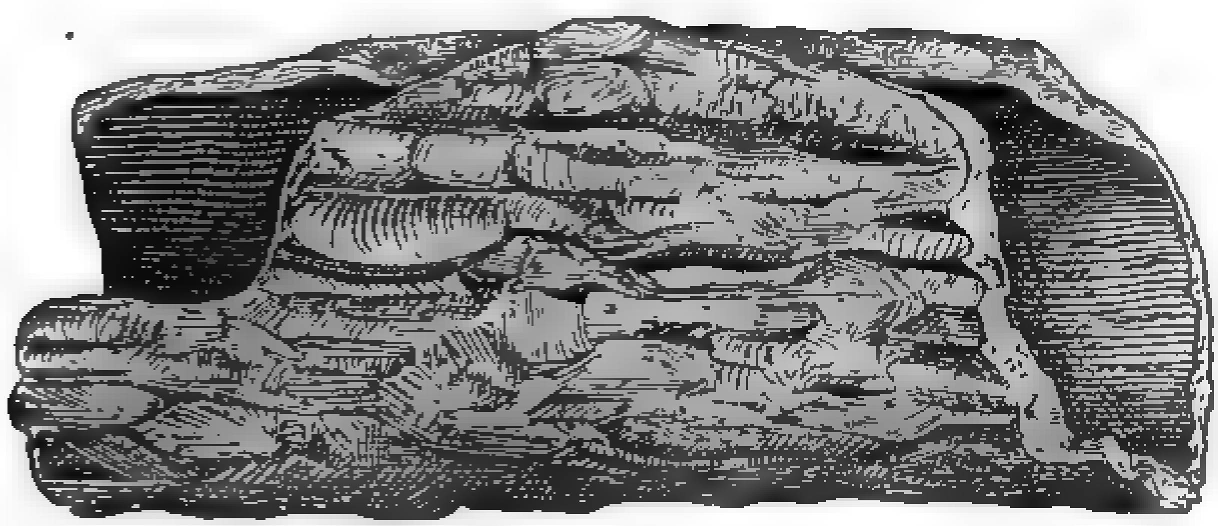


Fig. 282.

frequently marked with black spots; the inner surface is brownish-gray and striated lengthwise; the fracture is short and hard, yellowish-brown or leather-colored, the inner bark being obscurely tangentially striated on section; no odor, bitter taste. **C.** A peculiar bitter principle ditain, an alkaloid ditamine, etc.—**U.** Used for similar purposes as Alstonia constricta, but probably less active.

GROUP XLIII

The barks of this group are characterized by a more or less distinctly checkered or quadratically marked striation. This marking is due to an arrangement of bast-cells similar to that which gives the barks of the previous group the tangential mark-

ing, but in addition to this, the medullary rays and bast portions of the fibro-vascular bundles which give barks of Group XLI the radial striation are also well marked, and these two features together result in a distinctly quadratically checkered striation.

Thin, tough quills, glossy greenish or yellowish-brown outer surface; bitter astringent taste.............................**Salix.**
Flat, pale brownish-white pieces with corky layer removed; mucilaginous taste ....**Ulmus.**
Large, flat pieces or troughs, reddish-brown externally; fibrous fracture; acrid taste.......................................**Quillaja.**
Brittle pieces or small quills, externally yellowish-gray, inner surface somewhat darker; often with conchoidal depressions externally ....**Granatum.**
Quills or troughs, cork warty, ash-gray, or wanting; fracture splintery, coarsely fibrous.................................**Fraxinus.**
Large troughs or flat pieces, smooth, dark-brown and mottled on outer surface; bork generally absent.......................**Juglans.**

Salix

N. Willow Bark.—**O.** The bark of *Salix alba* and other varieties of *Salix; Salicaceæ.*—**H.** Europe and North America.—**D.** Thin, tough, flexible quills, or irregular pieces varying in thickness from ½ to 2 mm., the bark from the trunk often considerably

Fig. 283.

thicker; outer surface glossy greenish-gray to grayish or yellowish-brown, with a greenish layer under the thin outer bark; the corky layer sometimes slightly warty, in older barks occasionally silver-gray from lichenous patches; the inner surface smooth and pale cinnamon-brown, or sometimes slightly reddish, peeling off

in thin, finely fibrous liber sheets; fracture tough and fibrous; on transverse section (Fig. 283) the striation appears quadratically checkered; no odor; astringent and bitter taste.—**C.** Salicin, 1 to 3 per cent; tannin 10 to 12 per cent.—**U.** Tonic, astringent, slightly febrifuge. Dose: 1 to 5 grams.

Ulmus

N. Elm Bark, Slippery Elm Bark.—**O.** The inner bark of *Ulmus fulva; Ulmaceæ.*—**H.** United States.—**D.** In flat, flexible pieces or troughs of various sizes up to one-half meter or more in length and up to 1 or 2 decimeters in width, but usually smaller; about 3 mm. thick; the outer bark is removed so that both outer and inner surfaces are of the same color, pale brownish-white, the

Fig. 284.

inner surface slightly ridged longitudinally; fracture tough and very fibrous, mealy; a smooth-cut transverse section (Fig. 284) shows delicate quadratic markings due to tangential liber and radiating medullary rays; odor faint and taste insipidly mucilaginous.—**C.** Mucilage.—**U.** Demulcent and emollient. Dose, ad libitum, of the mucilage. Powdered slippery elm bark is said to be sometimes adulterated with corn meal, which can be detected by aid of a microscope.

Quillaja

N. Soap Bark, Quillaja.—**O.** The inner bark of *Quillaja saponaria; Rosaceæ.*—**H.** Chili and Peru.—**D.** In large, flat pieces or shallow troughs, the bark itself about 4 to 8 mm. thick; the outer surface, deprived of its bork, is brownish-white, with occasional

patches of reddish-brown corky layer, the inner surface is pale brownish-white, and the interior of the bark on fresh fracture is nearly white. The structure is woody and fibrous, fracture coarsely splintery, with pale brownish bast fibers with adherent white tissue and glistening from oxalate of calcium crystals; a smooth-cut transverse section (Fig. 285) is delicately

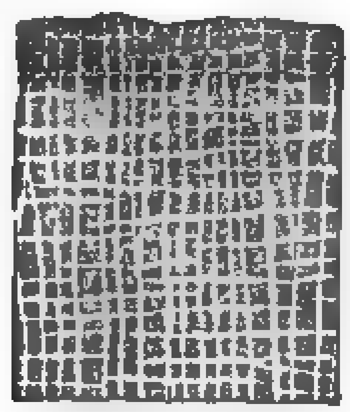


Fig. 285.

quadratically striated or checkered; odor none, taste persistently acrid.—**C.** About 9 per cent saponin.—**U.** The powder is sternutatory. Internally administered it is stimulant and diuretic. Dose: 1 to 2 grams in infusion.

Often used for washing delicate fabrics, silk, lace, etc.; also as a shampoo for the hair.

Fraxinus

N. White Ash Bark.—**O.** The bark of *Fraxinus Americana; Oleaceæ*.—**H.** North America.—**D.** Quills or troughs, the bark itself up to 5 mm, thick; outer bark or corky layer ash-gray and warty, but often removed; inner surface smooth and yellowish-white; fracture coarsely fibrous and splintery, a smooth-cut section showing quadratically checkered appearance; odor aromatic, weak; taste acrid bitter.—**C.** Glucoside, bitter principle, etc.; analysis incomplete.—**U.** Diuretic, uterine tonic and emmenagogue. Dose: 0.5 to 1 gram.

Juglans.—Stem bark is usually tangentially striated with the radiating markings obscure, but the bark of the root, which in its coarse appearance closely resembles that of the stem, except that it is often much thicker, is usually quadratically checkered, with

both tangential and radial striæ very plain, especially if a thin section is examined while being cleared in solution of hydroxide of potassium under the microscope, less so when totally cleared.

Granatum.—While most pieces of this bark show no striation, a few may be met with in which quadratic markings are delicately but distinctly shown. The bark may, therefore, sometimes be looked for in this group. For full description, however, see the next group.

GROUP XLIV

While a finished and cleared section of a bark of this group will show the same general structure that is observed in barks in general, yet in a smooth-cut section examined by reflected light the appearance is rather uniform, both in color and texture, and even in the few barks in which there are clusters of peculiar cells these are not arranged in any manner to suggest striation.

Heavy, long, flattish pieces or troughs, the bark up to 15 mm. thick, reddish-brown.................... **Coto.**

Similar to above, rust-brown, outer surface fissured and shrunken .... **Paracoto.**

Narrow, brittle fragments, shaved from twigs, about 1 mm. thick, whitish wood adhering to inner surface. **Prinos.**

Irregular pieces or troughs, outer surface grayish-brown with transverse warts, or reddish-brown patches where the cork is detached................ **Hamamelidis Cortex.**

Troughs or quills, up to 30 cm. long, younger bark mottled, older with rough cork.................. **Cascara.**

Thin bark in rolled quills, externally grayish-brown to blackish-brown with small transverse whitish cork-warts, inner surface brownish-yellow............. **Frangula.**

Thin quills or troughs, glossy purplish-brown with scattered warts and blackish dots................... **Viburnum Prunif.**

Quills or troughs, brownish-gray with whitish patches, marked with minute black dots and scattered small spines .... **Xanthoxylum. N.**

Quills or flattish pieces, brownish-gray with many large conical projections tipped with spines............ **Xanthoxylum. S.**

Irregular pieces or troughs, externally brown and rough from warts; inner surface pale brownish-yellow... **Chionanthus.**

Brittle pieces or small quills, externally yellowish-gray, inner surface somewhat darker; often with conchoidal depressions externally........................ **Granatum.**

Irregular pieces, outer surface marbled or grained, fragile, soft, rust-brown; characteristic taste and odor .... **Sassafras.**
Irregular pieces, outer surface pale yellowish-brown with lighter spots, inner surface smooth and brownish-yellow; fracture abrupt, almost waxy... **Ptelea.**

Coto

N. Coto Bark.—**O.** The bark of some unknown South American tree.—**H.** Bolivia.—**D.** In flattish pieces or troughs 0.2 to 0.3 meters long, the bark itself being from 5 to 15 mm. thick; or in irregular pieces (Fig. 286); outer surface reddish-brown, inner surface somewhat darker colored; fracture granular in outer layer, coarsely fibrous in bast portion of bark; a transverse section shows many golden-yellow clusters of sclerenchymatous

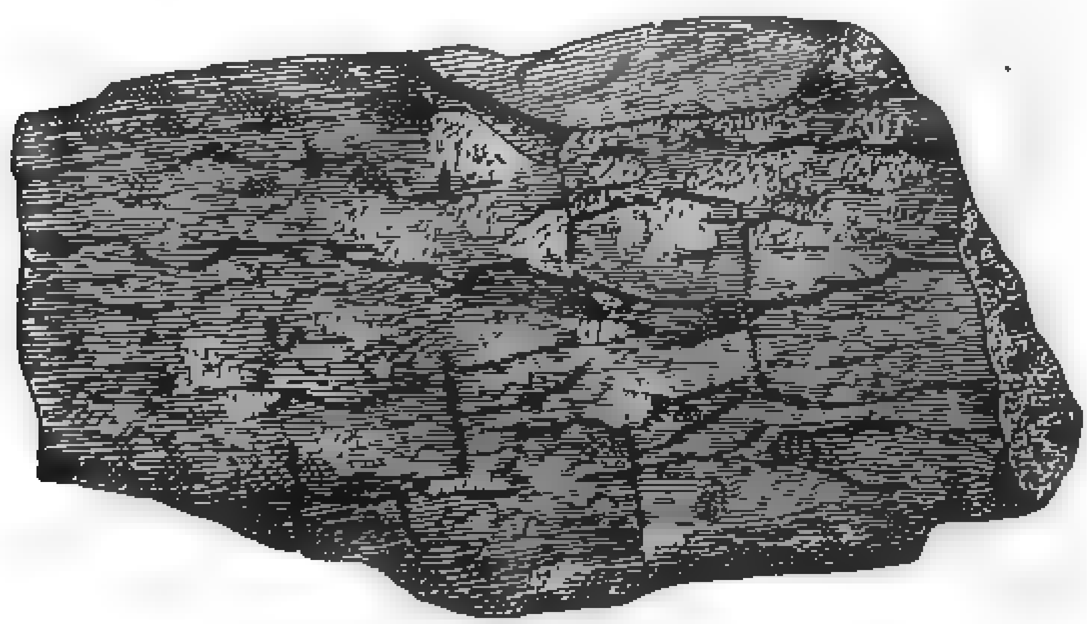


Fig. 286.

cells, but no striation; the odor is aromatic, reminding of cardamom, camphor, cajeput-oil with a faint trace of cinnamon; taste pungent aromatic and slightly bitter.—**C.** A bitter acrid principle called cotoin, several resins, volatile oil, etc.—**U.** Highly recommended as a remedy for acute and chronic diarrhœas, dysentery, etc. Dose: 0.06 to 1 gram.

A spurious coto bark, called **Paracoto Bark,** is also used. Its origin is also unknown, but it is probably the bark of a variety of *Nectandra.*—**H.** Bolivia.—**D.** In flat pieces of uniform rust-brown color on all surfaces, up to 15 or rarely 20 mm. thick, the

best being about two-thirds of the entire thickness; the outer surface is transversely fissured and shrunken in length so that the bast projects somewhat in the manner shown in Saigon cinnamon; the bast is coarsely fibrous, striate on the inner surface; a smooth transverse section shows a continuous tangential line of light-yellow sclerenchymatous cells under the cork, and many irregularly scattered clusters of similar cells throughout the bast portion, giving the latter a speckled or dotted appearance, but without any distinct arrangement in rows; a smooth longitudinal cut shows these clusters as short longitudinal lines; the odor is nutmeg-like.—**U.** In action this bark is similar to, but weaker than the genuine coto bark, although it is maintained by some writers that most, if not all, of the coto bark now in the trade is in reality paracoto bark.

Prinos

N. Black Alder Bark.—**O.** The bark of *Prinos verticillatus; Aquifoliaceæ.*—**H.** United States and Canada.—**D.** In thin, nar-

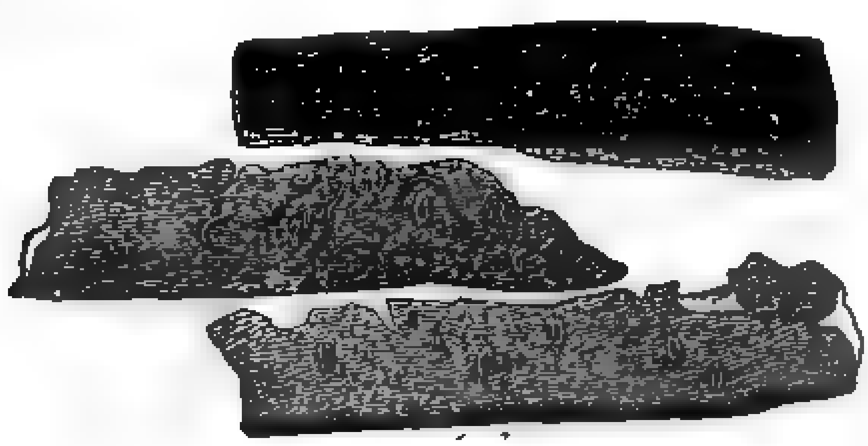


Fig. 287.

row brittle fragments, about 1 mm. thick, seldom more than 10 or 12 mm. wide and about 5 to 6 cm. long; the pieces of bark show that they were shaved from the twigs with knives, the edges being thin and the middle of the pieces thickest, with often shreds of whitish wood adhering; the outer surface is brownish-gray or ash-gray, with lighter colored irregular patches and darker colored dots and lines and often with patches of light gray lichens; the inner surface is pale green, except where the whitish shreds of wood are attached; fracture abrupt, showing no

striation in bast, but usually showing a fissure between the outer and inner bark, the corky layer separating readily even in the whole bark, with a tendency to curl the edges outward; a section when partly cleared, shows distinct radial lines or medullary rays, but when completely cleared these are indistinct; in a section cleared with solution of hydroxide of potassium the corky layer is brownish with a narrow layer of yellow cells underneath, then some parenchyma of the middle bark, often torn, then the inner bark radially striate, with large clusters of yellow bast-cells in its outer portion; nearly inodorous, taste bitter and astringent.—**C.** An unnamed amorphous bitter principle, resin, tannin, etc.—**U.** Astringent, bitter tonic. Dose: 2 to 5 grams, best in fluid extract.

Hamamelidis Cortex

N. Hamamelis Bark, Witchhazel Bark.—**O.** The bark of young branches of *Hamamelis Virginiana; Hamamelidaceæ.*—**H.** North America.—**D.** In irregularly quilled and bent pieces, or troughs,

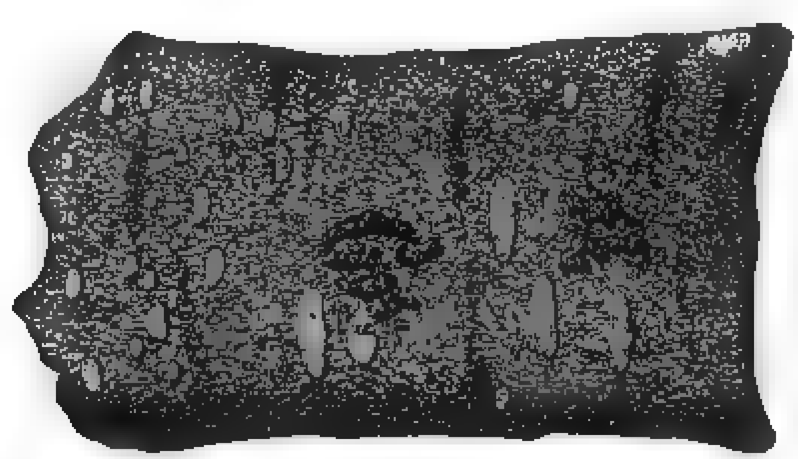


Fig. 288.

about 8 to 10 mm. wide and 1 to 1.5 mm. thick; outer surface smooth grayish-brown, with transverse warts, or reddish brown, with detached patches of darker-colored grayish-brown cork, dotted with scattered blackish warts; or occasionally the cork is rubbed off from the warts, when they appear lighter than the general surface; inner surface paler brown, slightly striate and with small elevated dots; the fracture abrupt or faintly tough in the bast of older pieces of bark; a section examined under the microscope shows faint tangential striation which is not seen with

the naked eye; the odor is faint but peculiar, and taste astringent.—**C.** About 8 per cent tannin.—**U.** Tonic astringent. Has been recommended as a remedy to prevent miscarriage, and locally as an application to wounds, bruises, hemorrhoids, etc. Dose: 2 to 4 grams.

The bark and twigs of witchhazel are chopped up together and distilled with water and alcohol to make witchhazel extract; nothing but alcohol and water distils over, so that the preparation and the process both are absurd.

Cascara Sagrada

N. Cascara, Cascara Sagrada, Chittem Bark.—**O.** The bark of *Rhamnus Purshiana; Rhamnaceæ.*—**H.** Western parts of United States, especially the region of the Rocky Mountains.—**D.** Thin, brittle troughs or quills, from 2 to 20 cm. long, the bark itself

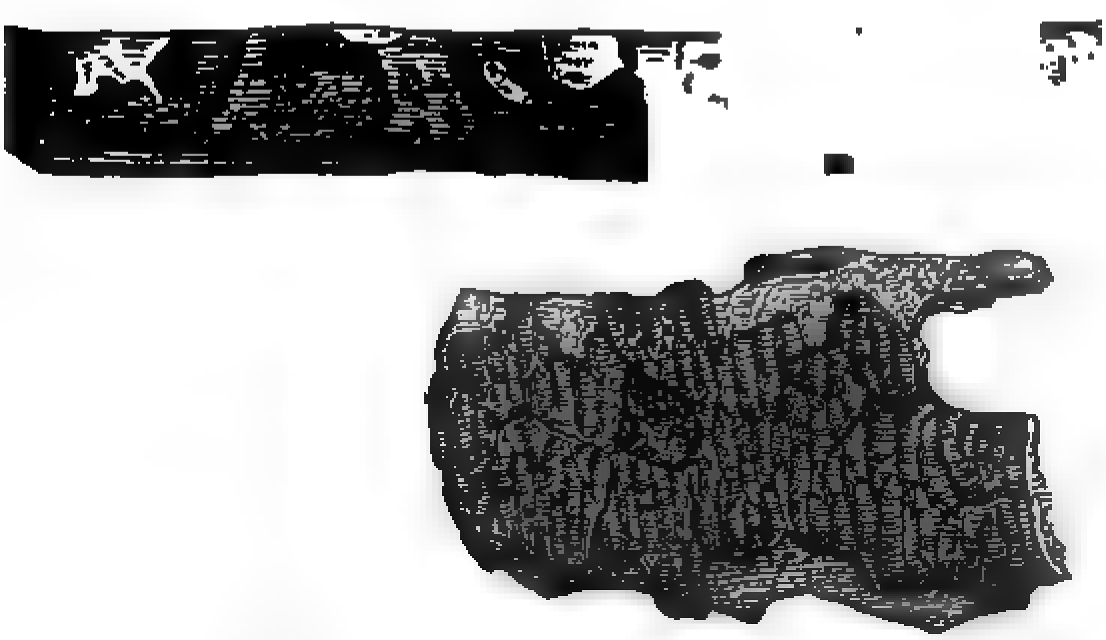


Fig. 289.

about 2 mm. thick; in quite young bark the outer surface is mottled as shown in Fig. 289, at the left, the dark parts being nearly black, the light parts whitish or ash-colored, with intermediate shades of brown; in older barks the contrast is not so marked, the entire surface appearing brownish-gray, although the peculiar figuring is often present; the inner surface is yellowish-brown to orange-brown when fresh, but darkening to a uniform brown with age. The root bark (Fig. 289, at the right) is thicker, darker, irregularly twisted or bent, and with a thick rough ex-

ternal bark, as shown in the smaller drawing. All thicker pieces are somewhat fibrous in fracture in the bast portion. Odorless, taste bitter, and the bark stains the saliva yellow upon being chewed.—**C.** Three different resins, tannin, and a neutral crystallizable substance.—**U.** Valuable tonic laxative in chronic constipation. Dose: 5 to 10 grams, best in fluid extract or other fluid form.

Cascara bark must be kept for at least one year after collecting, because the fresh bark is too acrid and produces griping.

Frangula

N. Buckthorn Bark.—**O.** The bark of *Rhamnus Frangula; Rhamnaceæ.*—**H.** Europe.—**D.** Quills or troughs, about the thickness of a

Fig. 290.

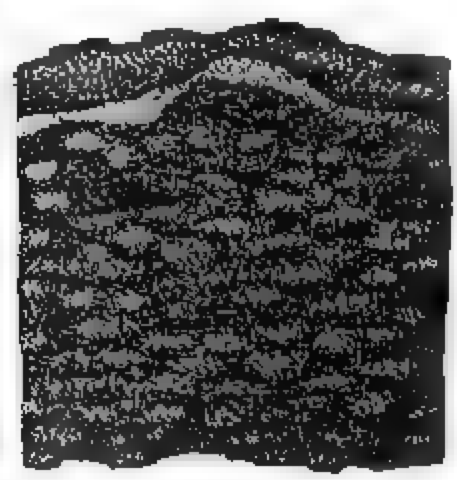


Fig. 291.

little finger, consisting of bark from 0.5 to 1 mm. thick; outer surface dull grayish or blackish-brown, with many small whitish, sometimes transversely elongated cork-warts (Fig. 290); the external layer or epidermis can be easily detached and shows a purplish color on its inner surface; the inner surface of the bark is smooth, orange or reddish-brown, or dark brown in older bark; fracture brittle, showing short fibers in the inner or bast portion; odor weak, but peculiar, and the taste sweetish-bitter.—**C.** Frangulin, which is a yellow, odorless and tasteless glucoside; emodin, etc.; on chewing the bark the saliva is colored yellow.—**U.** Mild purgative; when fresh, it is very violent in its action and therefore it must be kept for at least a year before it is used. Dose: 2 to 10 grams, best as fluid extract.

Fig. 290 shows the bark in natural size, while a transverse section is shown in Fig. 291.

Buckthorn bark must be kept at least a year after collecting, before using.

Viburnum Prunifolium

N. Black Haw.—**O.** The bark of *Viburnum prunifolium* and *V. Lentago; Caprifoliaceæ.*—**H.** United States.—**D.** Thin fragments or quills, externally glossy purplish-brown, with scattered warts and minute black dots; bark from older branches is grayish-brown; the thin outer bark separates easily from the greenish middle bark; the inner surface is smooth and of grayish-white color; fracture abrupt; Fig. 292 shows transverse section of bark of *V. prunifolium;* odor slight or none, and taste bitter and somewhat astringent.—**C.** Valeric acid, bitter principle viburnin, resin, tannin, etc.—**U.** Used to prevent abortion or miscarriage; it is also used in uterine derangements, as dysmenorrhœa, etc. Dose: 5 to 10 grams, best as fluid extract.

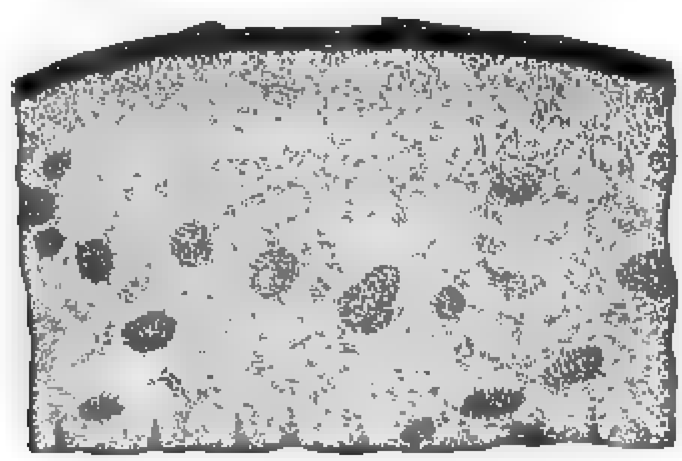


Fig. 292.

Xanthoxylum

N. Prickly Ash Bark.—**O.** The barks of *Xanthoxylum Americanum* and *X. Clava-Herculis; Xanthoxylaceæ.*—**H.** United States; *X. Amer.*, in Northern and Central States, and *X. Cl.-H.*, in Southern States.—**D.** **Northern variety**: Quills or troughs or irregular pieces, the bark itself about 1 mm. thick; the outer surface is brownish-gray with whitish patches and minute black dots, and some few glossy brown two-edged spines up to 5 mm.

long; the inner surface smooth and whitish; fracture abrupt, the broken surface apparently of uniform texture, but greenish in the outer and yellowish in the inner layers; no odor; taste bitterish and very pungent.—**D. Southern variety**: Resembles the former in general appearance and taste, but is up to 2 mm. thick and on the outer surface there are many large conical corky projections, sometimes up to 2 cm. high, and some stout spines

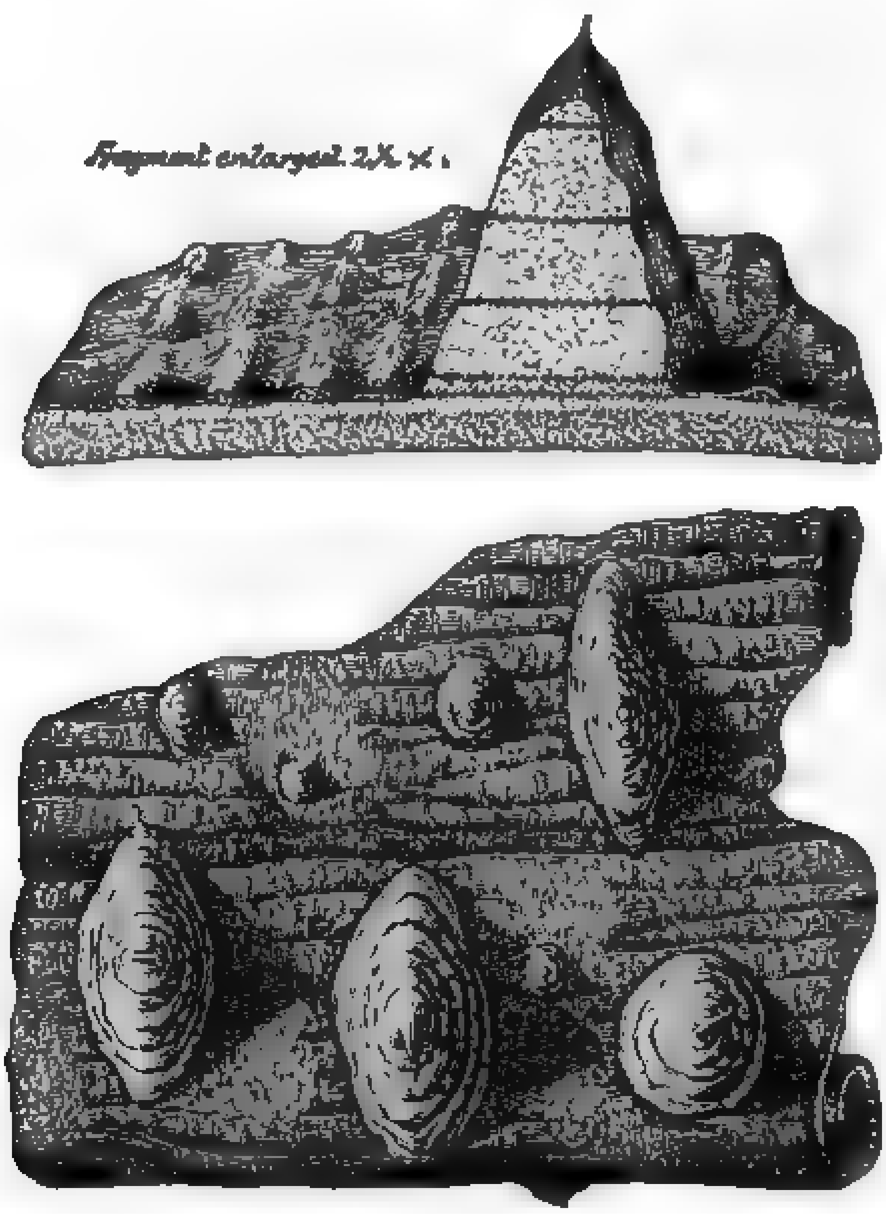


Fig. 293.

rising from a corky base. Northern Prickly Ash Bark has already been mentioned in Group XLI, because its section shows distinct radial striation, but it is described here with the frequently used Southern bark. Fig. 293 illustrates the crude appearance of Southern Prickly Ash Bark, and a longitudinal section of the same.—**C.** An acrid green oil, acrid soft resin, bitter

principle, tannin, etc.—**U.** Stimulant, sialagogue, alterative and emmenagogue. Dose: 0.5 to 2 grams.

The bark of *Aralia spinosa* may be mistaken for that of *Xanthoxylum* (especially for the Northern variety), but it is nearly smooth externally, with transverse rows of slender prickles.

Chionanthus

N. Fringe Tree Bark.—**O.** The bark of the root of *Chionanthus Virginica; Oleaceæ.*—**H.** United States.—**D.** Irregular, either tortuous or nearly straight troughs and pieces averaging from 2.5 to 10 cm. in length and 1 to 2.5 cm. in width, the bark itself being 2 to 5 mm. thick; the external surface is of a brown color, rough, marked by warts, transverse ridges and irregular scars; the inner

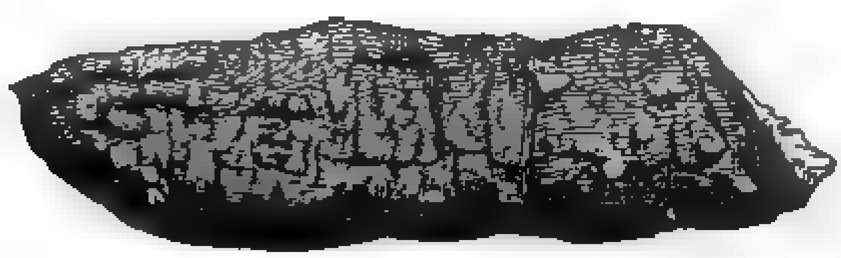


Fig. 294.

surface is pale brownish-yellow and finely striate; fracture brittle, the broken surface nearly white, the transverse section showing scattered brownish spots of bast-cell bundles, but no distinct striation; the odor is faint, reminding of rancid cacao butter; the taste is bitter.—**C.** No accurate analysis has been made, but saponin has been found.—**U.** Said to be alterative, aperient and diuretic. Dose: 2 to 8 grams, best as fluid extract.

Granatum

N. Pomegranate, Pomegranate Bark.—**O.** The bark of the stem and root of *Punica Granatum; Punicaceæ.*—**H.** Grows wild in Northern Africa and Southern Asia and Europe; cultivated in all sub-tropical countries.—**D.** The root bark occurs in troughs, more rarely in quills, up to 10 cm. long, the bark itself being about 1

mm. thick; externally it is grayish-yellow or brownish-gray, finely wrinkled (when young) or fissured and warty or scaly (when from older roots), but free from lichenous growths; the corky layer is comparatively thick and frequently marked with conchoidal depressions (see Fig. 295) due to sphacelation from secondary suber, or if these sphacelated portions have not yet become detached the external surface appears scaly; the inner surface is smooth, finely striate, grayish-yellow; fracture abrupt, brownish-yellow, generally of uniform finely granular texture, more rarely showing indistinct checkered or even radial markings; no odor, taste bitter. The bark of the stem is similar to that of the root, except that it occurs more frequently in quills, and has a less abundant cork-formation; it is moreover often marked, and often nearly covered on its external surface with lichenous patches.—**C.** Its action is supposed to be due mainly to an oily

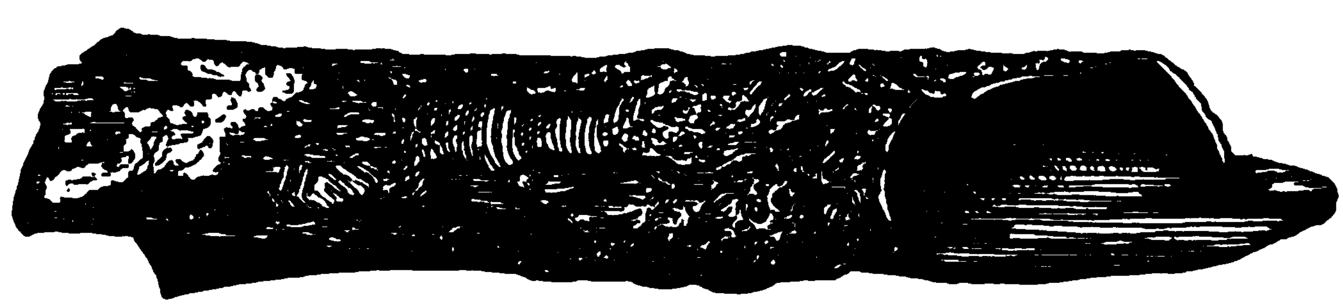


Fig. 295.

liquid alkaloid, pelletierine; it contains also three other allied alkaloids, about 20 per cent of punico-tannic acid, etc.—**U.** Anthelmintic and tænicide. Dose: 5 to 15 grams in decoction.

Sassafras has already been described, but the bast portion of many of the pieces, especially when the dry bark is broken, appear on transverse section to be of a uniform texture, so that the bark might also be looked for here. For description see Group XLI.

Ptelea or Wafer Ash has already been described in Group XLI; many pieces, however, break or cut with a peculiar almost waxy fracture and show uniform texture on the broken surfaces, so that the drug may sometimes be looked for here.

GROUP XLV

This group comprises only one bark, that of White Oak, which rarely or never comes into the drug-trade except coarsely ground or rasped.

An irregularly coarse, grayish-brown powder mixed with many tough coarse fibers .... **Quercus Alba.**

Quercus Alba

N. White Oak Bark.—**O.** The bark of *Quercus alba; Cupuliferæ.*—**H.** United States.—**D.** The barks of various kinds of oaks are gathered and used in the tanning industry. As brought into trade for this purpose they are massive pieces, often a meter or two in length and with the coarse bork attached. White oak bark when prepared for the drug trade, is freed from the bork, and is then in coarse flat pieces, the bark itself about 5 mm. thick, pale brown, the inner surface with sharp projecting longitudinal ridges; fracture tough and coarsely fibrous; a smooth-cut section shows quadratically checkered markings. As found in the drug trade, however, this bark is always coarsely ground, torn or rasped, so that it appears as an irregular powder, mixed with a mass of tough, coarse fibers, or vice versa, as coarse fibers with some coarse powder intermixed; the odor is faintly tan-like, taste strongly astringent.—**C.** From 5 to 15 per cent of a peculiar variety of tannic acid, quercitannic acid; younger bark contains proportionally more of this principle than does the older bark.—**U.** Astringent; the infusion is mainly employed externally as an injection in leucorrhœa, etc.; as a gargle in pharyngitis, and as a mouth-wash for spongy and bleeding gums.

Black Oak Bark (from *Quercus tinctoria)* colors the saliva yellow, which the official bark does not. This bark should not be employed, as its decoction or infusion, when used for instance as an injection in leucorrhœa, would stain the clothing.

GROUP XLVI

Leaf Buds

We have already learned that some authors include under the group of leaf buds such structures as bulbs, corms and even

tubers; these structures are better separated from leaf buds, and have already been described under their appropriate Groups, XXX to XXXIII, inclusive. We speak here only of true leaf buds, to which no part of the stem is attached, or of which at least the stem does not form a part. In Latin these structures are called "Gemmæ."

Long, tapering, scaly leaf buds, brown and covered externally with sticky resin.............................. **Populi Gemmæ.**

Populi Gemmæ

N. Poplar Buds.—**O.** The buds of *Populus nigra; Salicaceæ.*—**H.** Europe.—**D.** The drawing shows the appearance and size of these buds better than words could do; they are dark brown, wrinkled, and covered with a sticky resinous exudation, so that they often adhere to each other to form lumps; odor balsamic and

Fig. 296.

terebinthinate, taste bitterish, balsamic and somewhat pungent.—**C.** Resin, volatile oil, with probably small quantities of the balsamic acids.—**U.** Poplar buds are used in combination with other substances for making some of the popular cough preparations, in which they probably act similar to tolu, etc.; used also in preparing ointments, to which the buds impart some ingredient which prevents the fats from becoming rancid.

The buds of the North American plant, *Populus balsamifera*, are used in a similar manner as those from the black poplar; they are known as Balm of Gilead Buds.

LEAVES

The student is supposed to have acquired a knowledge of the nature of leaves and of their forms and structure from his reading some work on botany, or from the lectures on that subject.

There are some characteristics, however, which are of especial importance to pharmacognosists and which must be mentioned here. Leaves are covered by an epidermis, which usually has more stomata on the under side than on the upper side; it is also often thicker, as well as smoother, on the upper side than on the under; on section it is seen that cells are crowded closely against the upper epidermis, while they are separated by large intercellular spaces in the lower part of the leaf, these intercellular spaces communicating with the outer air by means of the breathing pores (stomata). As the "palisade" cells of the upper layer of the leaf also contain more chlorophyll bodies, the upper

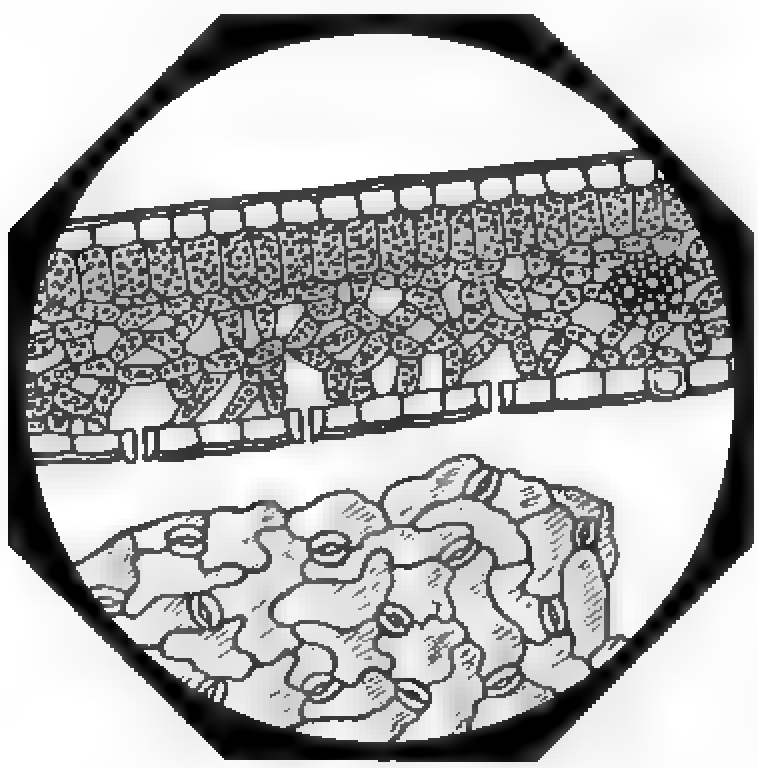


Fig. 297.

surface shows a deeper green color, while the under side is often made to look still paler by the innumerable small hairs, which grow by preference on the under side of leaves. Fig. 297 shows diagramatically a section of a part of a leaf, as well as a portion of epidermis.

When ground or broken leaves are to be examined, the epidermis and its cells, the shapes and distribution of the stomata, the presence or absence, as the case may be, of trichomes (outgrowths of the epidermis, as glands, hairs, scales, etc.), and the appearance of the latter constitute the characteristics by which a de-

termination is made, but when whole leaves are examined their shapes are described as in works of botany.

Leaves may be divided into *coriaceous* and *herbaceous* leaves, and while this division is not always distinct, nevertheless it will be found to be of practical convenience; in a few drugs, however, some lots will appear to be of one kind, and other lots resemble more the other kind, as is the case occasionally in coca, chestnut leaves, etc.

Leaves are coriaceous or leathery when the epidermis is thickened and hardened and the skeleton or frame-work of fibrovascular bundles is more or less lignified, so that the leaf retains its shape and size on drying. Herbaceous leaves, on the other hand, are those in which the epidermis and skeleton both are soft and succulent, so that the leaf shrinks in every direction on drying, in length, width and thickness, so that it becomes much crumpled, often much broken and torn, and sometimes considerably reduced in size; such leaves may be softened by steaming, when they are to be examined, as they can then be flattened out easily and their forms shown.

Some leaves are pellucid-punctate from numerous glands (often intercellular spaces in their interiors) filled with volatile oil, which appear as translucent dots on looking through the leaf at some bright light, or at the sun.

Most leaves become brownish on drying, so that the color is rarely a pure green in the drugs; moreover the extractive matters in the parenchyma of the leaves are usually dark brown, so that even in greenish leaves this brown coloring material preponderates over the green chlorophyll, and extracts or tinctures from leaves are usually brown.

Leaves may be grouped as follows:

Leaves	Coriaceous	Simple	XLVII
		Compound	XLVIII
	Herbaceous	Simple	XLIX
		Compound	L

It must be remembered, however, that flowering tops consist mainly of leaves, and some drugs which are supposed to consist of leaves alone are often terminal twigs with leaves and occasionally flowers or even immature fruits; especially is this the case with the narcotic herbs, as belladonna, aconite leaves, etc., and

so commonly and regularly was it the case with hyoscyamus that now the Pharmacopoeia defines this drug to be "the leaves and flowering tops." Some leaves are sometimes found in the trade as leaves alone, but more frequently as leafy twigs, and a few of these have been already described as "leafy branches" in Group XXXIV; mention of these is, however, also made under the appropriate groups of leaves.

GROUP XLVII

Simple Coriaceous Leaves

Scythe-shaped, 15 to 30 cm. long, margin entire; grayish-green .... **Eucalyptus.**

Roundish-obovate, about 15 mm. long, margin crenate or serrate; yellowish-green; pellucid-punctate, with a gland at each serration .... **Buchu (short).**

Slender linear-lanceolate leaves, about 3 to 4 cm. long, margin serrate; otherwise like the preceding .... **Buchu (long).**

Obovate or oblong spatulate, 15 to 20 mm. long, margin entire; lower surface reticulate; brownish-green .... **Uva Ursi.**

Variable in size and shape, ovate, obovate-oblong to lanceolate, 2 to 7 cm. long, margin entire; green to brownish; with a curved line on each side of the midrib .... **Coca.**

Obovate to oblong, 10 to 25 mm. long, margin with 2 to 6 dentations on each side; light-green .... **Damiana.**

Ovate-oblong, to 5 cm. long, with long petiole, margin finely crenulate; whitish to grayish-green, downy .... **Salvia.**

Rolled into small balls or cylinders; grayish-green, bluish-green to blackish .... **Thea.**

Oblong or oblong-lanceolate, acute at both ends, 5 to 10 cm. long, margin entire, somewhat wavy; pellucid-punctate; brownish or brownish-green .... **Laurus.**

Broadly oval, about 5 cm. long, margin entire; rough on both sides, glossy on upper and hairy on under surface; brownish-green .... **Boldus.**

Linear, about 25 mm. long, margin revolute; dark-green above, whitish woolly, glandular, with prominent midrib underneath .... **Rosmarinus.**

Lanceolate, short-petiolate, 7 to 10 cm. long, to 25 mm. broad, margin entire and somewhat wavy; thin, smooth, and often with scars from insects .... **Duboisia.**

Ovate, petiolate, about 5 cm. long, margin entire; thick, glaucous, pale green .... **Manzanita.**

Roundish-oval or obovate, about 4 cm. long, 2 or more cm. broad, margin slightly serrate with appressed spicular teeth; smooth, glossy, green or brownish-green..........**Gaultheria.**
Oblanceolate, about 5 cm. long, margin serrate at apex and nearly entire near base; smooth, dark-green............**Chimaphila.**
Oblong-lanceolate, 5 to 10 cm. long, margin irregularly dentate; greenish or brown; upper surface smooth and covered with brownish resin, often agglutinated into lumps, lower surface white-hairy............................**Eriodyction.**

Eucalyptus

N. Eucalyptus.—**O.** The leaves of *Eucalyptus globulus; Myrtaceæ.* Only the leaves from the older parts of the tree should be

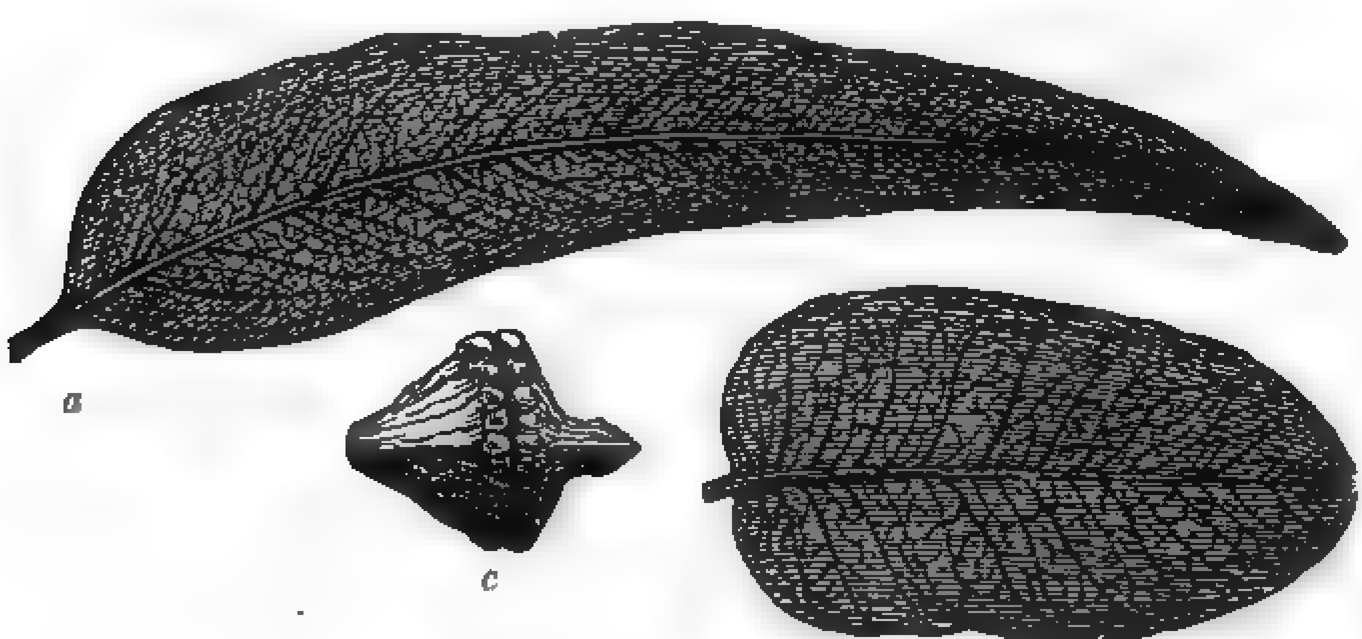


Fig. 298.

used, as those from the younger branches are comparatively worthless.—**H.** Indigenous to Australia, but now cultivated in all subtropical countries.—**D.** This drug has already been mentioned under Group XXXIV, leafy twigs, as it comes into trade in that shape in the bales; but as it is usually garbled before reaching the retail dealer, the latter obtains it as leaves alone, and therefore its description has been postponed to this place. The leaves are petiolate, lanceolate scythe-shaped, from 15 to 30 cm. long, more or less rounded at the base, tapering at apex, margin entire, coriaceous, pellucid-punctate or glandular, grayish-green; a leaf from the older parts of the tree is represented in half natural size in Fig. 298 (*a*); odor strongly camphoraceous and the taste pungently aromatic, bitter and astringent, leaving a cool-

ing taste in the mouth. A leaf from the younger branches is represented in Fig. 298 (*b*), also half natural size; such leaves are ovate, faintly cordate at base, rounded or only slightly pointed at apex, bluish-green, thinner and less glandular than the scythe-shaped leaves, but otherwise similar except that they are far less active medicinally, for which reason they should not be used. In the bales twigs and unopened buds, of which latter one is illustrated (*c*), are generally present, though absent in the garbled drug as it reaches the retail pharmacist.—**C.** About 6 per cent volatile oil, called "eucalyptol," some tannin, resin, etc.—**U.** Stimulant tonic, stomachic, blennorrhetic, diaphoretic and diuretic; by some esteemed to be febrifuge. Dose: 1 to 5 grams, best in fluid extract. The volatile oil is used as an antiseptic.

Buchu

N. Buchu. The word "buchu" ("bucco, bukko") is of African origin, and is indeclinable and neuter.—**O.** The leaves of *Barosma betulina; Rutaceæ.*—**H.** Southern Africa.—**D.** There are

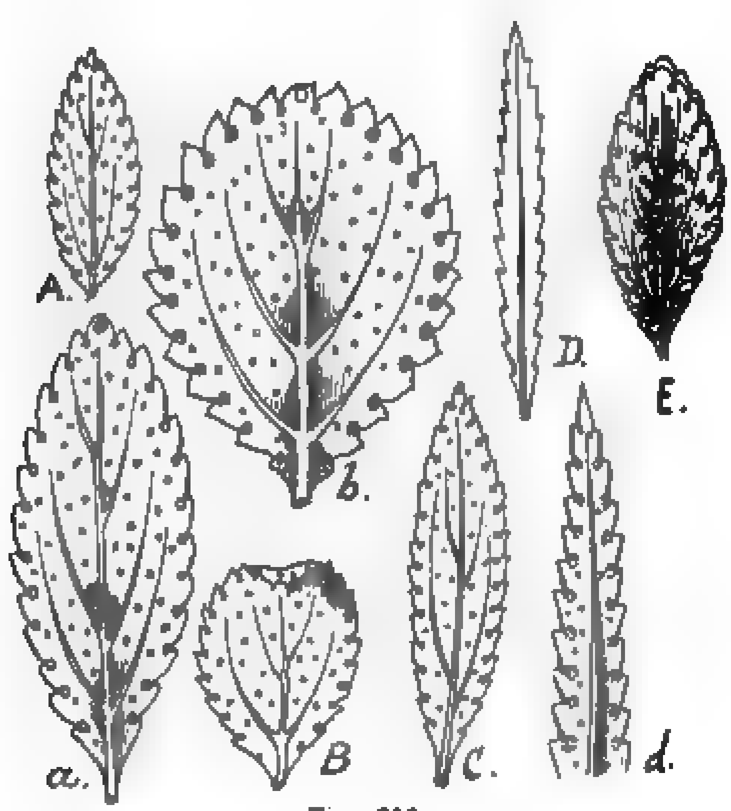


Fig. 299.

two trade varieties of this drug, *short* and *long*, of which the former is the best, although the long is the higher-priced variety.

Short Buchu is composed of leaves about 15 mm. long, round-

ish-obovate with somewhat wedge-shaped base, or varying between oval and obovate, obtuse at apex, margin crenate or serrate, leaves rather thick, dull yellowish-green, pellucid-punctate, with a gland at each indentation; odor and taste strongly mint-like, aromatic, pungent and bitterish.—**C.** One to 1½ per cent volatile oil, etc.; the oil is the active constituent.—**U.** Stimulant diuretic. Dose: 1 to 2 grams, best in fluid extract.

Long Buchu is obtained from *B. serratifolia;* the leaves are 3 to 4 cm. long, thin, slender, lanceolate, green, less leathery but otherwise similar to short buchu. Long buchu is often mixed with the leaves of *Empleurum serrulatum,* which are narrower and without oil-glands at the extreme apex.

The illustrations in Fig. 299 are as follows: *A,* leaf of *Barosma crenulata,* natural size, and *a,* the same enlarged; *B,* leaf of *B. betulina,* natural size, and *b,* the same enlarged; *C,* leaf of *B. serratifolia,* natural size; *D,* leaf of *Empleurum serrulatum,* natural size, and *d,* apex of same, enlarged; *E,* leaf of *Barosma crenata,* which sometimes constitutes part of the drug.

Uva Ursi

N. Uva Ursi, Bearberry Leaves.—**O.** The leaves of *Arctostaphylos Uva-ursi; Ericaceæ.*—**H.** Northern Europe and America.—**D.** Short-petioled, obovate or oblong-spatulate, 15 to 20 mm. long and 5 to 8 mm. broad, apex obtuse, margin entire and slightly revolute, upper surface with veins depressed, lower surface dis-

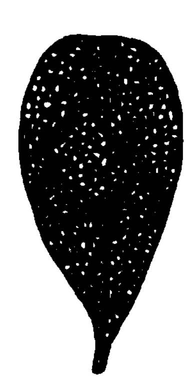


Fig. 300.

tinctly reticulate, brownish-green to brown; odor faint and taste strongly astringent and somewhat bitter.—**C.** About 6 per cent tannin, arbutin, etc.—**U.** Astringent, diuretic and nephritic; especially esteemed in kidney and bladder troubles. Dose: 2 to 5 grams, in infusion or fluid extract.

Coca

N. Coca Leaves, Cucha Leaves. The word "Coca" is of Peruvian origin and is indeclinable and neuter; to treat it as a noun of the first (Latin) declension is a mistake.—**O.** The leaves of *Erythroxylon Coca* and its varieties; *Erythroxylaceæ.*—**H.** Peru and Bolivia; cultivated.—**D.** From 2.5 to 7.5 cm. long, short-petioled, closely net-veined on both sides, with a thick midrib, on both sides of which there is a more or less distinctly marked curved line (not connected with the venation) running from the base to the apex, margin entire, greenish to greenish-brown or

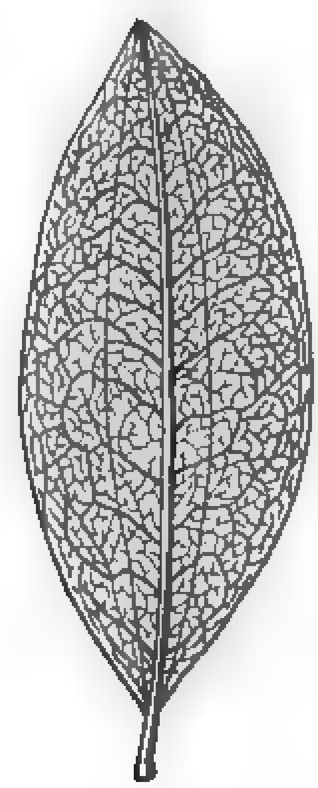


Fig. 301.

even brown in color with faint tea-like odor and bitterish aromatic taste. Fig. 301 shows a leaf of Erythroxylon Coca known as "Huanuco Coca."

The leaves of the Truxillo variety are smaller than the Huanuco Coca, but are said to be richer in cocaine. They are derived from *Erythroxylon Truxillense;* they are up to 5 cm. long and one-half as broad, pale green; thin, and brittle.—**C.** Cocaine, etc. Both varieties should yield at least 0.5 per cent of the ether-soluble alkaloids of coca.—**U.** Stimulant, resembling coffee in action. Said to be a general excitant. Dose: 1 to 5 grams, chewed, or in

infusion or fluid extract. Cocaine is a local anæsthetic; used as a stimulant and intoxicant by so-called "cocaine-fiends," to whom the habitual use of this drug proves as destructive as the opium or hashish habits do to their respective votaries.

Damiana

N. Damiana.—**O.** The leaves of *Turnera aphrodisiaca, T. microphilla,* and perhaps other varieties of *Turnera; Turneraceæ.*—**H.** Mexico and lower California.—**D.** The form and size of the leaves are well shown in the drawings. Variable, short-petioled, obovate, or oblong, apex somewhat obtuse, base wedge-shaped and margin with three to six teeth on each side, veins prominent beneath, light green, nearly smooth, often much broken and

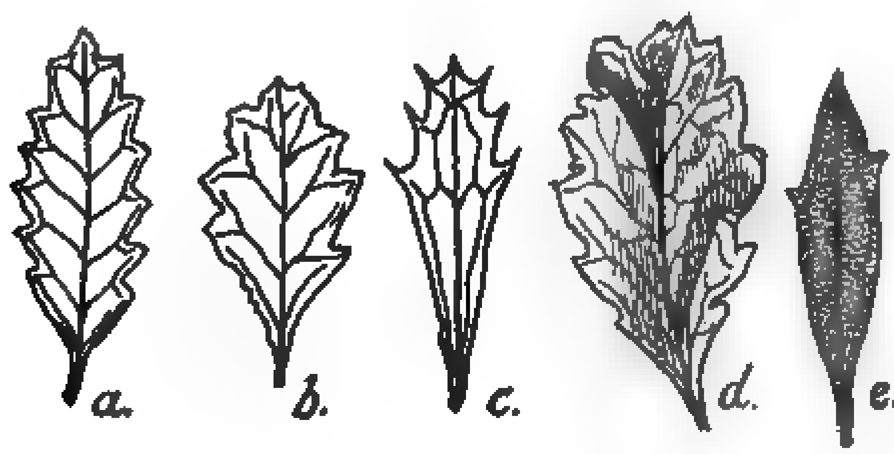


Fig. 302.

crumbled; odor agreeably aromatic and taste slightly aromatic. Mexican Damiana consists of small smooth leaves (*a*, *b* and *c*, in Fig. 302), and California Damiana consists of larger and broader leaves with redundant margin (*d*).—**C.** Volatile oil and resin.—**U.** Generally reported to be a valuable aphrodisiac. Stimulant, tonic and diuretic. Dose: 5 to 10 grams in fluid extract or infusion.

False Damiana consists of the leaves of *Aplopappus* (or *Haplopappus) discoideus (Compositæ),* which are frequently sold as Damiana. Fig. 302 (*e*), shows appearance and size. About 2 to 3 cm. long, oblanceolate, with from one to three dentations on each side, rough, and minutely dotted; frequently mixed with the flower-heads (or with parts of same, involucre, florets and hairy pappus) of the same plant. The odor and taste of False Damiana

differs from that of the genuine drug, and resemble more those of Grindelia. These leaves contain resin, but lack the aroma of true Damiana, and when present must be considered as adulteration.

Salvia

N. Sage.—**O.** The leaves of *Salvia officinalis; Labiatæ.*—**H.** Cultivated.—**D.** With long petiole, blade ovate-oblong, about 3 to 7 cm. long, base rounded, apex obtuse or subacute, thick, somewhat wrinkled, grayish-green, soft-hairy and glandulous on under side; margin delicately crenulate; odor aromatic, taste aro-

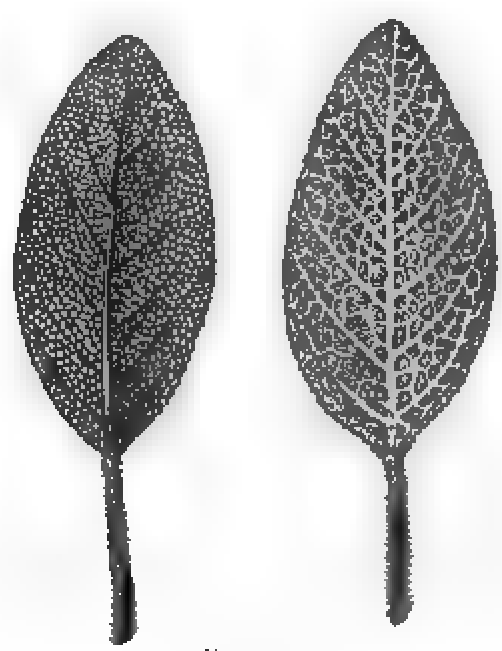


Fig. 303.

matic, bitter, somewhat astringent. Wild, gray, thick sage is considered the best ("Italian Sage").—**C.** Volatile oil, some resin, tannin, etc.—**U.** Stimulant, astringent and vulnerary. Dose: 2 to 5 grams in infusion. The infusion is a popular gargle for sore throat, etc.

Thea

N. Tea.—**O.** The leaves of *Thea Chinensis (Sinensis); Ternstrœmiaceæ.* According to Hayne there are three distinct varieties of this plant: *Thea Bohea, T. viridis* and *T. stricta,* distinguished by shape of leaves and fruits.—**D.** In the trade these leaves are found rolled into little balls or cylinders, varying in size, and in color from grayish-green, bluish-green to blackish. The leaves themselves, when unfolded after steaming or infusing, are found to be short-

petiolate, oval to oblong-lanceolate, 25 to 75 mm. long, about half as broad, acute at both ends, margin serrate, smooth or slightly hairy and glandular along the veins on the under side; it is seldom, however, that a leaf can be found entire, as they are mostly in small fragments in the drug, but sufficiently large pieces to identify the general form are not so rare; odor peculiar and taste astringent and bitterish. The drawing of a whole leaf (Fig. 304) shows size, shape and venation of a large leaf and the other drawings show a portion of the epidermis of the under side (*a*) and a section of the leaf (*b*) with the peculiar sclerenchymatous cells in its

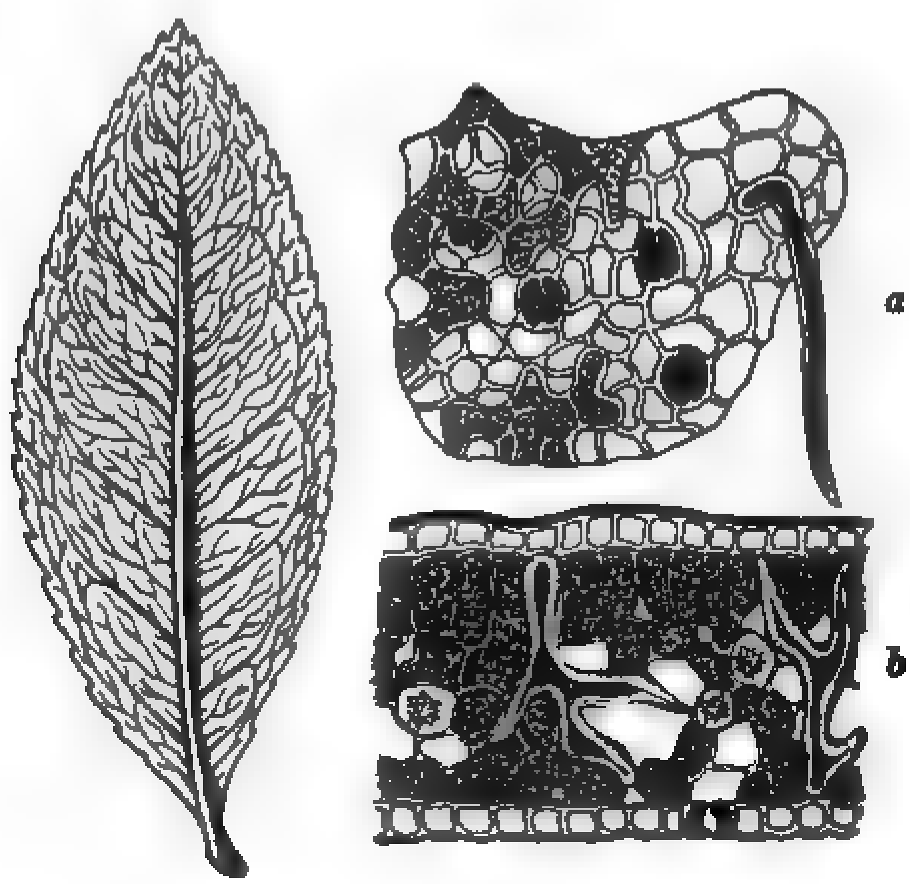


Fig. 304.

interior.—**C.** Volatile oil, up to 3 or 4 per cent of theine (identical with caffeine), up to 20 per cent tannin, etc.—**U.** Stimulant, nervine and astringent. Mainly used in infusion as a drink, the habitual and excessive use of which may produce nervous and digestive derangements.

Tea is commercially divided into a number of varieties, which may, however, be broadly grouped as *black* and *green* teas. These varieties are obtained from the same plant, the differences depending on size and age of leaves, time of gathering, mode of preparing, as well as on peculiarities of soil and climate. In the fol-

lowing lists the names of these varieties are given in the order of quality, beginning with the finest, made from the tender leaf buds, down to the coarsest, from the hard and woody expanded leaves.

Black Teas; with leaves usually merely rolled into cylinders; *var.:* Flowery pekoe, orange pekoe, pekoe, pekoe souchong, souchong, congon, bohea.

Green Teas; with leaves usually rolled into balls or twisted cylinders, and generally colored green artificially; *var.:* Gunpowder, imperial, hyson, young hyson, hyson skin, caper.

Green teas are considered better or more fragrant, but they contain more tannin and are therefore more astringent. Adulteration with other leaves can be determined by infusing the leaves and then spreading out and comparing the suspected leaves with the known shape and structure of the genuine leaves.

Laurus

N. Laurel Leaves, Bay Leaves.—**O.** Leaves of *Laurus nobilis; Lauraceæ.*—**H.** Europe.—**D.** Fig. 305 shows size and venation;

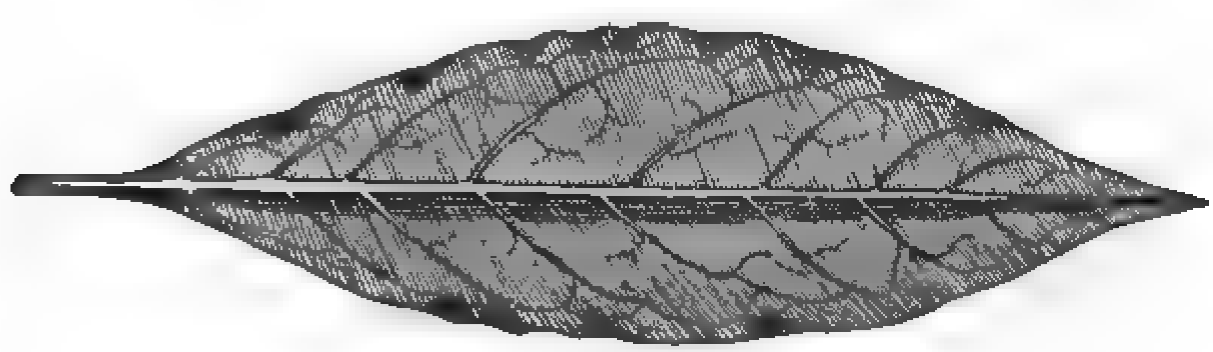


Fig. 305.

short petiole, oblong or oblong-lanceolate, acute at both ends, about 7 to 10 cm. long, margin entire and somewhat wavy, finely veined on under side, pellucid-punctate, greenish-brown to brownish, odor agreeably aromatic and taste bitterish.—**C.** Volatile oil, some bitter substance, tannin, etc.—**U.** Employed as a flavoring in cooking.

Boldus

N. Boldo, Boldo Leaves.—**O.** The leaves of *Peumus Boldus; Monimiaceæ.*—**H.** Chili, cultivated.—**D.** Broadly oval, about 5 cm.

long, margin entire, rough on both sides from raised glands, glossy on upper and hairy on under surfaces, brownish-green to reddish-brown; disagreeably fragrant and pungently aromatic and bitter.—**C.** About 2 per cent volatile oil, an alkaloid boldine, a glucoside boldoglucin, some aromatic resin, tannin, etc.—**U.**

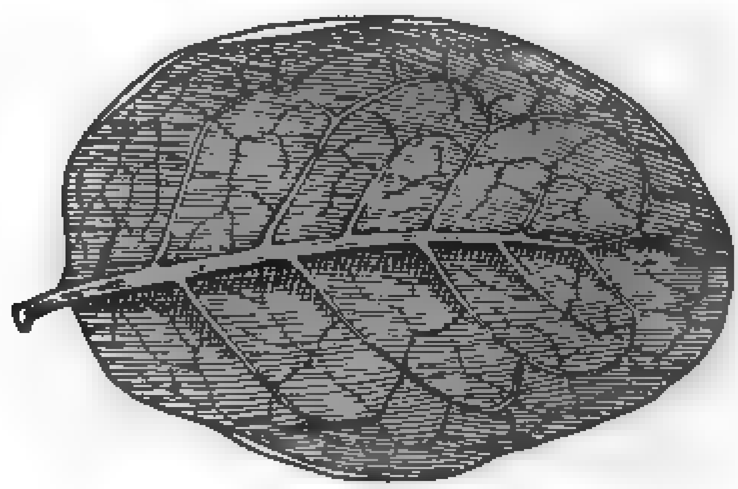


Fig. 306.

Stimulant nervine, excitant; also useful in inflammations of genito-urinary organs, in hepatic affections, etc. Dose: 0.1 to 0.5 gram, best in fluid extract.

Rosmarinus

N. Rosemary Leaves, Rosemary.—**O.** The leaves of *Rosmarinus officinalis; Labiatæ.*—**H.** Cultivated.—**D.** Linear, nearly sessile, about 2 to 3 cm. long, 1.5 to 3 mm. broad, margin entire and slightly revolute, dark-green above, whitish woolly, glandular and with prominent midrib underneath; odor camphoraceous,

Fig. 307.

taste strongly aromatic.—**C.** Volatile oil and bitter extractive.—**U.** Stimulant, diuretic, diaphoretic, carminative and emmenagogue. Dose: 1 gram or more in infusion.

Duboisia

N. Duboisia Leaves.—**O.** The leaves of *Duboisia myoporoides; Solanaceæ.*—**H.** Australia.—**D.** Short-petiolate, broadly lanceolate,

about 7 to 10 cm. long, 20 to 30 mm. broad, rather thin, smooth, apex acute, base long and tapering, margin entire and somewhat wavy, midrib coarse and prominent, odor slight, but disagreeable if any, and taste bitter acrid. Fig. 308 shows this leaf in natural size.—**C.** Duboisine (similar to hyoscyamine or atropine), resin, etc.—**U.** Rarely used except for the manufacture of duboisine. The action is similar to that of belladonna, like which it is some-

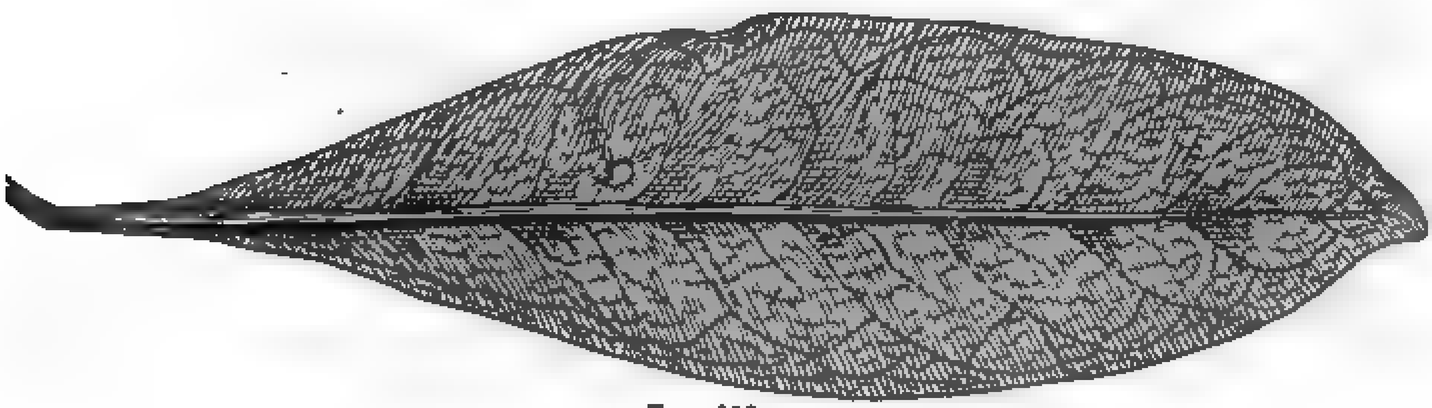


Fig. 308.

times used. Excitomotor, in large doses narcotic poison, anodyne; dilates the pupil of the eye. Dose: 0.05 to 0.3 gram in fluid extract.

Manzanita

N. Manzanita.—**O.** The leaves of *Arctostaphylos glauca; Ericaceæ.*—**H.** California.—**D.** Ovate-oblong, or elliptical, petiolate,

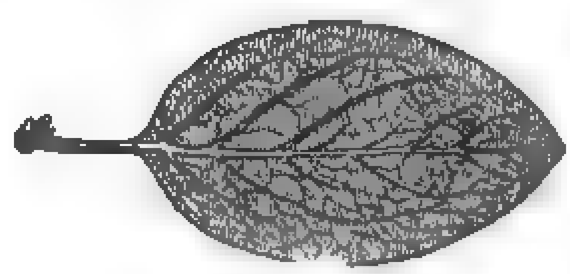


Fig. 309.

about 5 cm. long, apex acute, base obtuse, margin entire, thick, hairy, pale-green; without odor, taste astringent and somewhat bitter.—**C.** Arbutin, about 10 per cent tannin, etc.—**U.** Used like uva ursi; astringent, diuretic, tonic. Dose: 2 to 8 grams in fluid extract.

Gaultheria and Chimaphila are rarely met with in trade as leaves alone, and for this reason they have already been fully

described under Group XXXIV, Leafy Twigs. As garbled lots, consisting of leaves alone may, however, be met with occasionally, they are also mentioned here.

Eriodyction is officially and generally described as "leaves" and would therefore be looked for here, but as a matter of fact this drug often consists of twigs with leaves attached, belonging therefore under Group XXXIV, where it has been described and figured.

See also the next group.

GROUP XLVIII

Compound Coriaceous Leaves

A compound leaf consists of a number of leaflets attached to a midrib; the drugs mentioned under this group are easily recognized as compound leaves when they come into the trade in bales, but they are sometimes carefully garbled and may then be mistaken for simple leaves; this is especially true of India or Tinnevelly Senna. Care must be taken not to mistake compound leaves for leafy branches.

Whole leaf with 8 to 10 leaflets; leaflets various sizes, 2 to 4 cm. long, lanceolate, uneven at base, entire, grayish-green...... **Senna.**
Whole leaf with 5 to 11 leaflets; leaflets about 10 to 15 cm. long, oval or ovate-oblong, emarginate, uneven at base, margin entire, pellucid-punctate, dull grayish-green.................. **Pilocarpus.**

Senna

N. Senna, Senna Leaves.—**O.** The leaflets of *Cassia acutifolia* (Alexandria Senna) and *C. angustifolia* (India Senna) *Leguminosæ*.—**H.** Africa; the India Senna is cultivated in India.—**D.** There are two trade varieties, known as "Alexandria Senna" and "India Senna," which must be separately described: **Alexandria Senna** in bales sometimes consists of the whole leaf, a midrib with four to five pairs of leaflets, mixed with a short and broad legume, and occasionally with other or foreign leaves. Before using it should be carefully garbled and all foreign substances rejected; when thus garbled Alexandria senna consists of broadly lanceolate or ovate-lanceolate, almost sessile, subcoriaceous leaflets,

about 15 to 25 mm. long and up to 10 mm. broad, apex tapering or pointed, base unequally oblique, margin entire, grayish-green and slightly pubescent; odor peculiar, taste nauseous bitter. **India Senna** generally occurs in trade well garbled, as leaflets alone, lanceolate, from 3 to 5 cm. long, 10 to 15 mm. broad, apex acute, base unequally oblique, margin entire, smooth, yellowish-green or dull green; odor peculiar, somewhat tea-like, and taste nauseous bitter and somewhat mucilaginous.—**C.** Cathartic acid, chrysophan, etc.—**U.** Active, but not acrid cathartic. Dose: 2

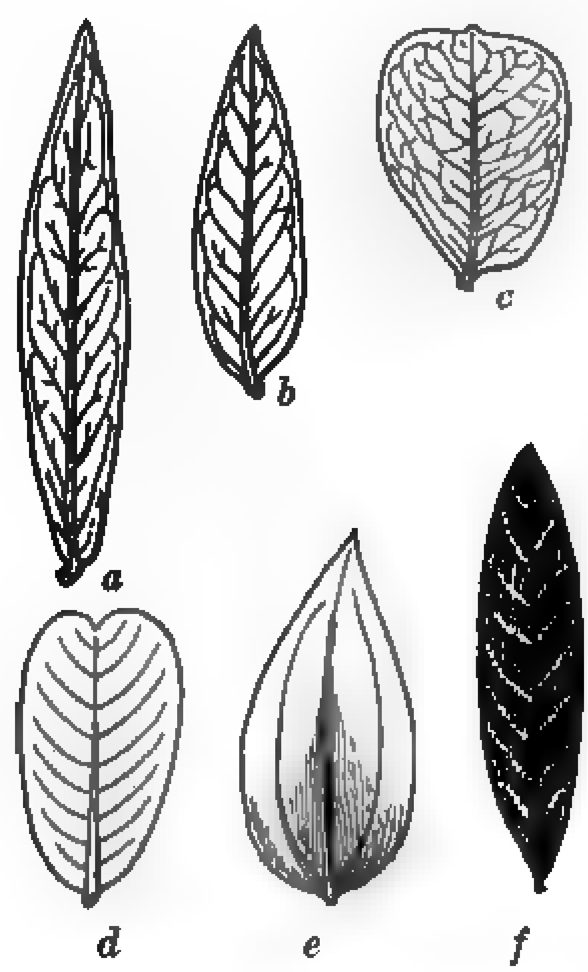


Fig. 310.

to 10 grams in infusion or fluid extract; often combined with magnesium sulphate.

The letters refer to drawings in Fig. 310. Alexandria senna (*b*) is usually considerably broken, mixed with pods, midribs coarse stems, and with more or less of the leaves of *Solenostemma Argel* (*f*) or "Argel leaves;" it also frequently contains leaves from *Cassia obovata* (*c*) and sometimes of *Tephrosia* (*d*) and *Coriaria* (*e*).

India senna is much less broken than Alexandria senna. The senna cultivated at Tinnevelly, in East India, is the best kind of

· whole leaflets of good
· · and other admixtures.
· from admixtures, are
· than India senna, and
· for retail trade, the
· of its clean and un-
·tion (a).

· ·LEAVES

· · ·aflets of *Pilocarpus Jabo-*
·aca.—**H.** Brazil.—**D.** In

Fig. 312

·s·ing of midrib with from five to
· often even with a piece of twig
·ig. 311. The leaflets (Fig. 312-*a*) are

short-stalked, broadly oval or ovate-oblong, apex obtuse or slightly emarginate or notched, unequal at the base, margin entire and slightly revolute or rolled back on the under surface of the leaflet, smooth, pellucid-punctate, grayish or dull green color; odor slightly aromatic when bruised and taste somewhat pungent and bitter.—**C.** The alkaloids, pilocarpine, and jaborine, volatile oil, etc.; the drug should yield not less than 0.6 per cent of alkaloids on assay.—**U.** Sialagogue and diaphoretic. Dose: 1 to 5 grams, in infusion or fluid extract.

Fig. 311 shows a whole leaf of *P. Jaborandi* as it occurs in the drug; Fig. 312 shows a leaflet (*a*) natural size, showing venation; a portion of epidermis of under surface, slightly enlarged, showing gland dots (*b*); the same more highly enlarged, by reflected light (*d*), and by transmitted light (*e*).

The leaflets of *P. microphyllus* are much smaller, but otherwise, similar.

GROUP XLIX

Simple Herbaceous Leaves

An herbaceous leaf has delicate and soft epidermis and the vessels and prosenchymatous cells of the skeleton are but slightly or not at all lignified, so that on drying it shrinks in every direction, becoming thinner and smaller than the growing leaf before gathering. In the drugs of this group many leaves are much shrunken and crumpled, so that they must be softened by steaming or infusing before they can be flattened out for examination, and most of them are so much broken that perfectly shaped leaves are not always easily obtained.

Hyoscyamus, Maidenhair Fern, Tea, the drugs of Group IX, **Flowering Tops**, and the **Inflorescence of Tilia** may easily be mistaken for simple herbaceous leaves, and attention is therefore called to them here. See also introductory remarks to Group IX.

Broadly ovate, thin, smooth, 5 to 15 cm. long, petiolate, apex tapering, margin entire; usually as "tops" with two unequal leaves at nodes........................**Belladonnæ Folia.**

Ovate, 10 to 30 cm. long, petiolate, margin crenate, reticulate on under surface, densely hairy................**Digitalis.**

Lanceolate, about 10 to 15 cm. long, apex acute, base unequally cordate, margin finely crenulate, under surface with prominent venation and deeply reticulate. .**Matico.**

Obliquely ovate or oval, about 10 cm. long, short petiolate, margin irregularly sinuate or wavy-toothed..........**Hamamelis.**

Ovate to oblong lanceolate, acuminate, petiolate, 15 to 25 cm. long, from 5 to 8 cm. broad, evenly feather-veined, margin serrate ....**Castanea.**

Ovate, petiolate, about 15 to 25 cm. long, margin irregularly sinuously lobed or toothed, much wrinkled and broken ....**Stramonii Folia.**

Oblong or oval-lanceolate, 10 to 30 cm. long, petiole broadly winged, apex acute, margin crenate, grayfelty or hairy....................................**Verbasci Folia.**

Large peltate leaf, about 9-lobed, up to 50 cm. or more across, lobes acuminate, margin serrate, much wrinkled and broken................................**Ricini Folia.**

Oval or ovate, lanceolate, up to 50 cm. long, apex acute, margin entire, brown..............................**Tabacum.**

Rolled into small balls or cylinders; grayish-green, bluishgreen, to blackish................................**Thea.**

Ovate, irregularly lobed leaves, up to 25 cm. long, graygreen, hairy; usually as leafy tops; flowers or capsules within persistent calyces often present............**Hyoscyamus.**

Frond of fern with triangular leaflets, with sporangia under recurved edges of lobes, and thin glossy-brown stipes ....**Adiantum.**

Belladonnæ Folia

N. Belladonna Leaves, Deadly Night-Shade.—**O.** The leaves of *Atropa Belladonna; Solanaceæ.*—**H.** Europe and Asia; cultivated in Europe and America.—**D.** Broadly ovate, up to 15 cm. long, half as broad, apex acuminate, base tapering, petiolate, margin entire, thin and wrinkled, smooth, brownish-green on upper and grayish-green on under surfaces, both surfaces have minute whitish dots when examined with a lens; odor, if any, somewhat narcotic, taste disagreeable and bitter.—**C.** The alkaloid atropine is the most important principle; there are besides this belladonnine, hyoscyamine, etc.—**U.** Narcotic, mydriatic (dilating the pupil of the eye), checks excessive sweats and suppresses secretion of milk; also physiological antidote to opium. Dose: 0.05 to 0.1 gram, best in tincture or fluid extract.

This drug very often consists of the tops, the twigs forming

obtuse angles at the nodes, with two leaves of very uneven size at each node; frequently with either flowers or fruits (blackish-red berries with persistent calyx) also present. The leaves, flowers and fruits are shown in Fig. 313 in natural size.

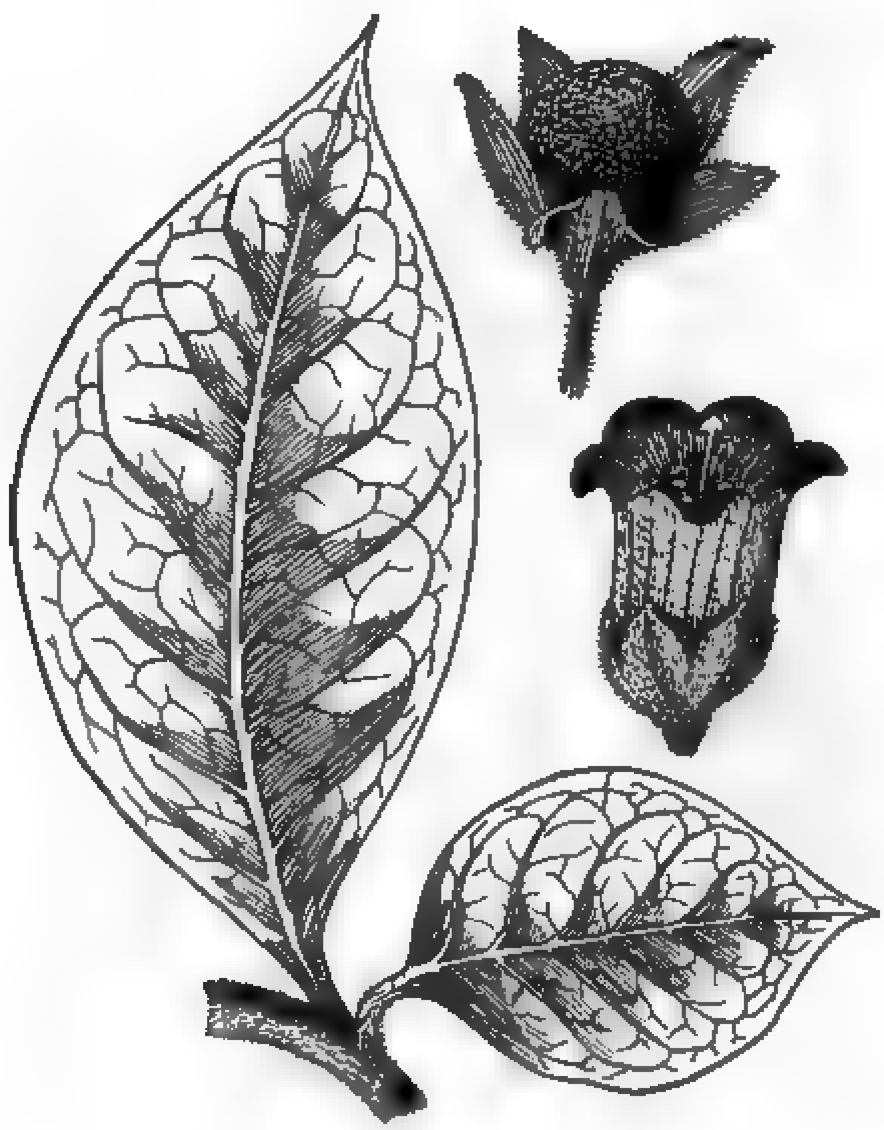


Fig. 313.

Antidotes: If a poisonous dose has been taken, the stomach should be promptly evacuated, either with an emetic or stomach tube, and opium or physostigma given to counteract the physiological effects of the belladonna on the nervous system.

Digitalis

N. Digitalis, Foxglove.—**O.** The leaves of *Digitalis purpurea; Scrophulariaceæ.* Only the leaves of the plants of second year's growth should be gathered.—**H.** Europe.—**D.** Ovate-oblong, 10 to 20 cm. long, 5 to 10 cm. broad, apex acute, margin irregularly crenate, much wrinkled and broken, downy, the larger leaves

with petiole winged, the smaller leaves nearly sessile; under surface deeply reticulate with prominent midrib and venation, pale-green on upper surface and whitish-felty underneath; hair two or three-celled, simple or club-shaped, nodulated, not branched; odor faint, taste bitter, nauseous and somewhat acrid.—**C.** The

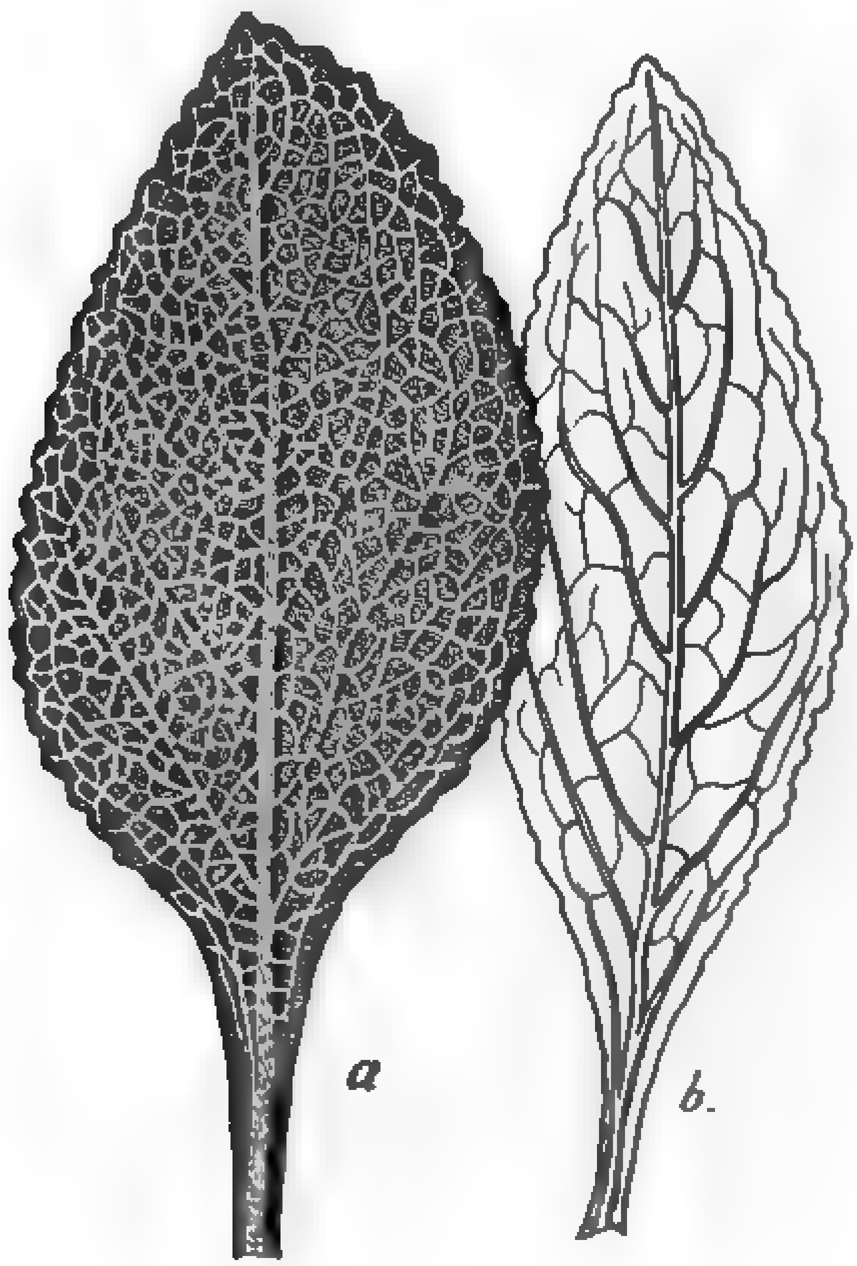


Fig. 314.

alkaloid digitalin, etc.—**U.** Excito-motor, heart stimulant; diuretic. Dose: 0.03 to 0.3 gram, best in tincture.

The shaded drawing in Fig. 314 shows the under side of a leaf of second year, while the outline drawing shows the more slender shape of the first year's leaf, both natural size. Leaves from cultivated plants are less hairy than those from wild-grown plants; they are also less active.

Digitalis, matico and mullein leaves have been confounded with each other. By comparing the figures of digitalis and matico the differences between these two drugs will become sufficiently obvious. Mullein leaf resembles digitalis more nearly in shape and general appearance, but it can readily be distinguished from digitalis by its characteristic branched hairs which are easily seen with a lens of even quite low power.

Digitalis does not keep well, and it should be kept in well-closed containers, away from the light, and a new supply should be procured each season when the fresh crop arrives.

Matico

N. Matico.—**O.** The leaves of *Piper angustifolium; Piperaceæ.*—**H.** South America.—**D.** Oblong-lanceolate, up to 15 cm. long, apex pointed, base unevenly heart-shaped, short-petiolate, margin obscurely crenulate, the upper surface tesselated (see smaller drawing in Fig. 315, enlarged 5 diameters), the under surface with

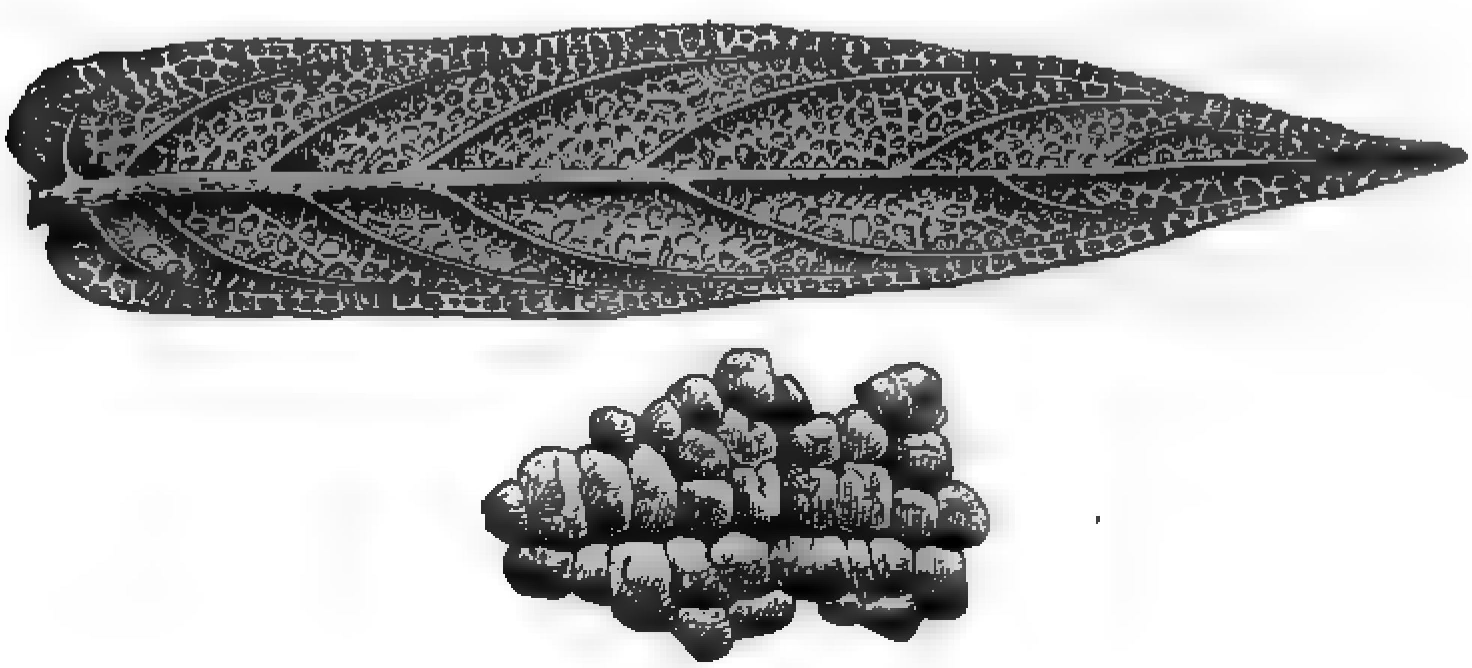


Fig. 315.

very prominent hairy midrib and venation, and deeply reticulate (drawing two-thirds natural size), wrinkled, brittle and very much broken, brownish-green; odor peculiar, taste aromatic, spicy and bitter.—**C.** About 2½ per cent volatile oil, a soft, green, pungent resin, artanthic acid, tannin, etc.—**U.** Stimulant blennorrhetic, useful in chronic affections of the urinary organs. Dose: 2 to 5 grams, best as fluid extract.

Hamamelidis Folia

N. Hamamelis, Witch-Hazel Leaves.—**O.** The leaves of *Hamamelis Virginica; Hamamelidaceæ*.—**H.** North America.—**D.** Obliquely ovate or oval, 10 or more cm. long, short-petiolate, apex obtuse, margin irregularly sinuate or wavy-toothed, base uneven, slightly cordate, feather-veined, nearly smooth, much crumpled and broken, green; no odor, taste bitter, astringent.—**C.**

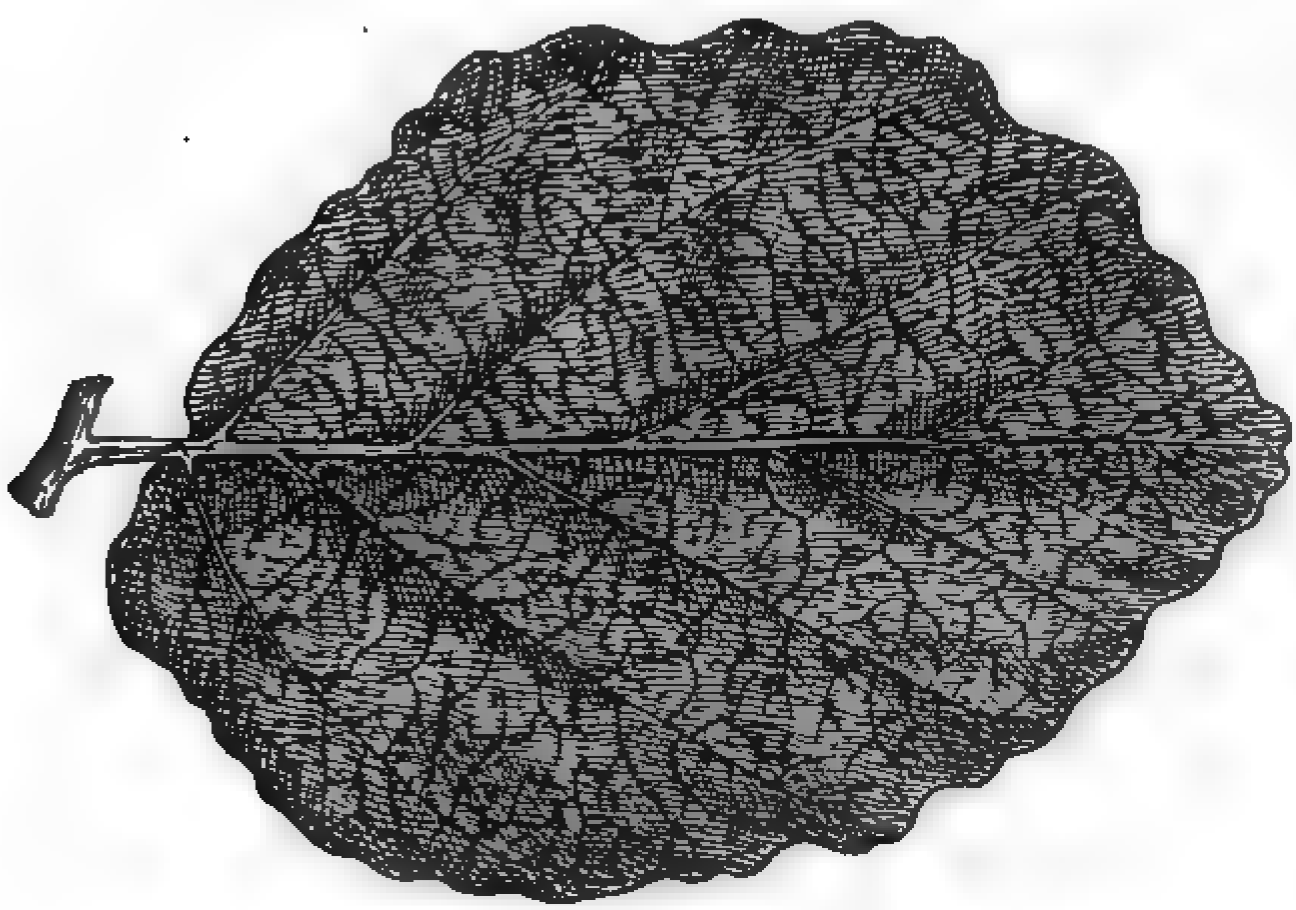


Fig. 316.

Tannin, bitter principle, etc.—**U.** Tonic, astringent; vulnerary. Dose: About 5 grams in infusion or fluid extract.

Castanea

N. Chestnut Leaves.—**O.** The leaves of *Castanea dentata; Cupuliferæ*.—**H.** Europe and America.—**D.** Ovate to oblong-lanceolate, up to 25 cm. long, 5 to 8 cm. broad, petiolate, apex pointed, margin sinuate-serrate, feather-veined, smooth, green to pale brownish-green; odor slight, taste astringent.—**C.** About 9 per cent tan-

nin, etc.; no complete analysis has been made.—**U.** Tonic, astringent and sedative; has been highly spoken of as a remedy for

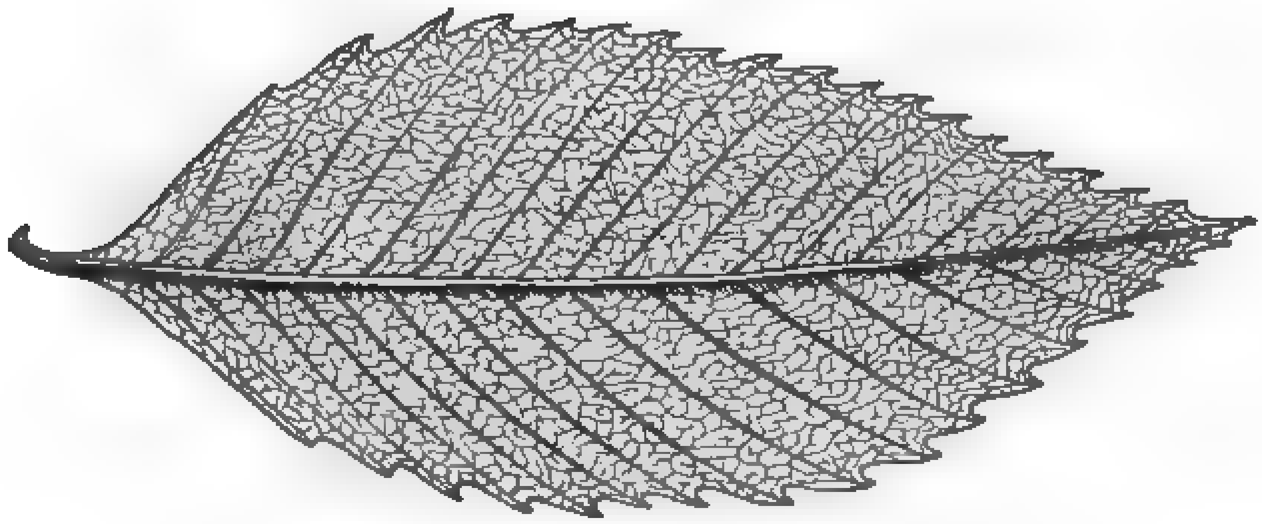


Fig. 317.

whooping cough. Dose: 2 to 5 grams, best in infusion or fluid extract.

Fig. 317 shows the leaf one-half natural size.

Stramonii Folia

N. Stramonium Leaves, Thornapple, Stinkweed, Jimson Weed.—**O.** The leaves of *Datura Stramonium* and *D. tatula; Solanaceæ.*

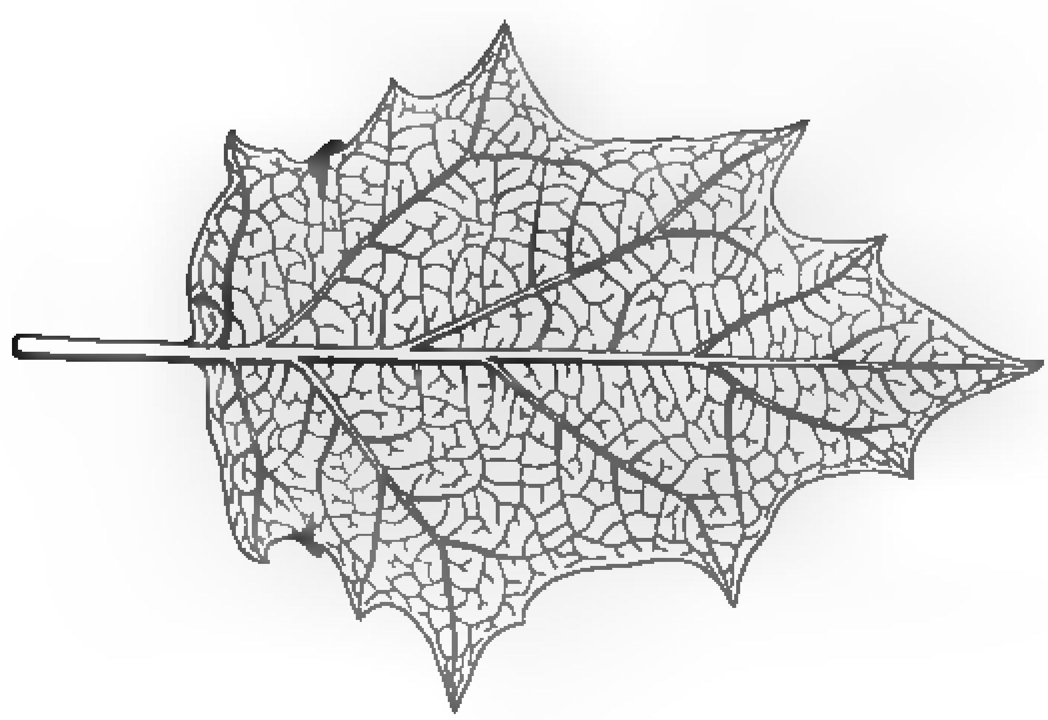


Fig. 318.

The leaves of *D. tatula* are gathered and used like those of *D. Stramonium,* and sold under the same name; there is no dif-

ference between the leaves of the two plants.—**H.** Native of Asia, but naturalized everywhere.—**D.** Ovate, petiolate, up to 25 cm. long, apex pointed, margin irregularly sinuously toothed or lobed, the sides often unsymmetrical in lobes and venation, lateral veins leaving midrib at a sharp angle instead of first running parallel with it, thin, much shrunken, crumpled and broken, slightly hairy on the veins, green or brownish-green; nearly inodorous, but developing a disagreeable narcotic odor on rubbing and crushing in the hands, taste nauseous bitter.—**C.** Daturine (closely related to if not identical with atropine, hyoscyamine, etc.) The drug should yield not less than 0.25 per cent of mydriatic alkaloids.—**U.** Anodyne, narcotic and hypnotic; often smoked as a remedy against asthma. Dose: 0.05 to 0.25 gram; average dose about 0.1 gram.

Fig. 318 shows the leaf about one-third natural size.

Verbasci Folia

N. Mullein Leaves.—**O.** The leaves of *Verbascum thapsus* and other varieties of *Verbascum; Scrophulariaceæ.*—**H.** Europe and America.—**D.** Ovate, elliptic or oblong-lanceolate, the smaller

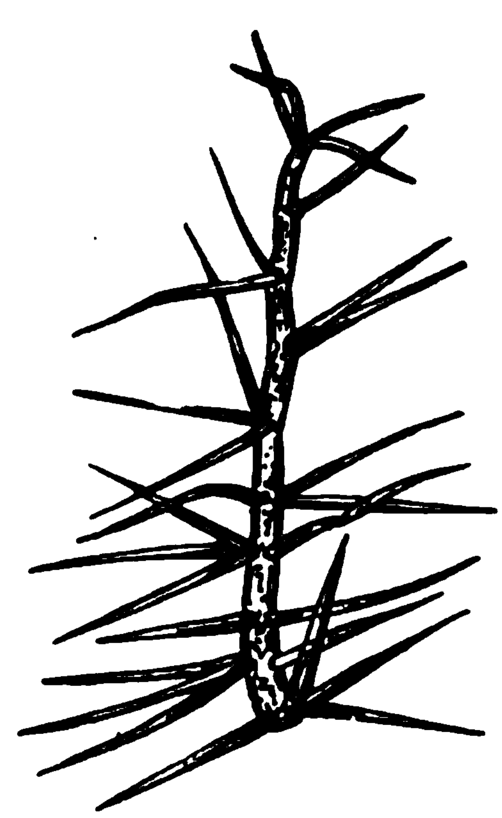


Fig. 319.

(upper) leaves sessile, the larger (lower) leaves tapering to a more or less winged petiole, to 30 cm. long, apex acute, margin crenate, densely felty or hairy on both surfaces, (the hairs branched; see Fig. 319), grayish-green; inodorous, taste muci-

laginous.—**C.** Mucilage, etc.—**U.** Demulcent; used as an ingredient of pectoral teas, mainly to increase the bulk of the package when sold.

Dose: Ad libitum in infusion. The leaf resembles that of Digitalis, but the shapes of the hairs will differentiate them.

Ricini Folia

N. Castor-oil Leaves.—**O.** The leaves of *Ricinus communis; Euphorbiaceæ.*—**H.** Native of India; cultivated in sub-tropical and warm temperate regions in Europe and America.—**D.** Large peltate or shield-shaped leaves, about 9-lobed, up to 50 cm, or

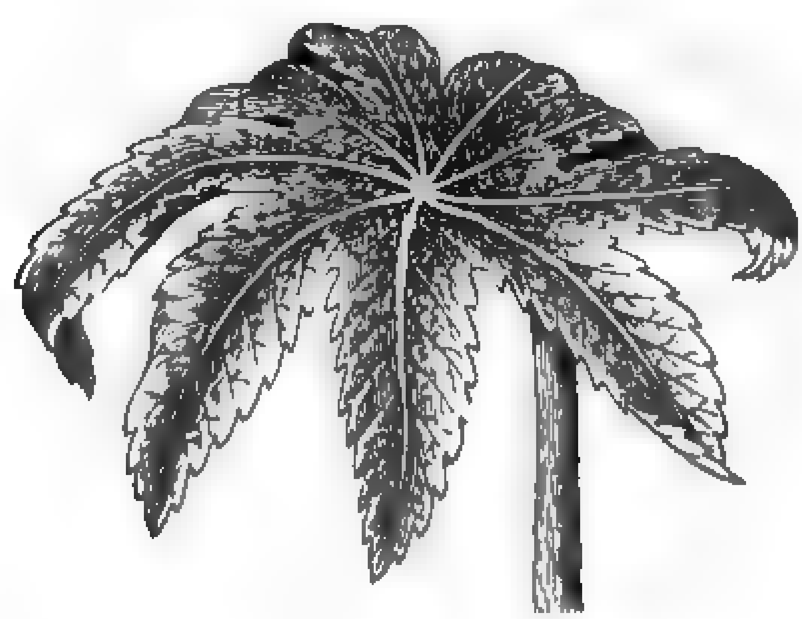


Fig. 320.

more across, lobes acuminate with serrate margins and prominent coarse central veins (Fig. 320), much shrunken, wrinkled and broken, dark-green; little odor, taste somewhat acrid and disagreeable.—**C.** An undetermined acrid cathartic principle.—**U.** Castor-oil leaves are said to increase the secretion of milk when taken internally by, or when applied as cataplasms to the breasts of nursing women. Best used in the form of strong infusion. Dose: 5 to 15 grams.

Tabacum

N. Tobacco.—**O.** The leaves of *Nicotiana Tabacum; Solanaceæ.*—**H.** Cultivated; especially in subtropical and warm temperate regions.—**D.** The well-known dried commercial leaves as used by

tobacconists are also used as the drug. Broadly oval or ovate, up to 50 cm. long, apex acute, margin entire, short petiolate or sessile, brown, brittle, glandular-hairy; odor peculiar, heavy and oppressive, taste acrid bitter and nauseous.—**C.** Two to eight per cent of the extremely acrid and poisonous alkaloid nicotine, nicotianin, resin, extractive, etc.—**U.** Much employed for smoking, chewing, and as a sternutatory or snuff. A powerful depressant and poison; sedative, emetic and narcotic. Dose: 0.01 to 0.05 gram; to be used with great care!

Thea, which is really a coriaceous leaf, but artificially crumpled and broken, might be mistaken for a herbaceous leaf and be sought for in this group; it is fully described under Group XLVII.

For **Hyoscyamus** see Group IX.

For **Adiantum** see Group XV.

GROUP L

Compound Herbaceous Leaves

This group comprises the herbaceous compound leaves, which are like the simple herbaceous leaves in their structure, only differing in shape, so that the methods of examining them are the same as for leaves of Group XLIX.

Some of the flowering tops of Group IX, as for instance Chelidonium, Millefolium, Absinthium, Coptis, Cannabis, etc., may be taken to belong in this group; on the other hand, Aconite Leaves often come into trade as flowering tops, although only the leaves are supposed to be wanted. Adiantum might also be mistaken for a compound leaf. These facts must therefore be kept in mind.

Trifoliate, with long petiole, side-leaflets nearly sessile, leaflets entire or irregularly lobed........................**Rhus Radicans.**

Outline round or subcordate, petiolate, 5 to 10 cm. in diameter, 3 to 5 parted, the lobes deeply incised and wedge-shaped ....**Aconiti Folia.**

Large, broad leaves, with hollow petiole, twice or thrice decompound ....**Conii Folia.**

Long-petioled, bi- or tri-pinnately decompound; lobelets entire, spatulate, somewhat fleshy..........................**Ruta.**

Rhus Radicans

N. Poison Ivy, Poison Oak. Formerly used under the names *Rhus Toxicodendron,* or *Toxicodendron.*—**O.** The leaves of *Rhus radicans; Anacardiaceæ.*—**H.** North America.—**D.** The figure shows the shape, but is much reduced in size; with long petiole, trifoliate, the end-leaflet stalked, the side-leaflets sessile or nearly so, leaflets 7 to 12 cm. long and up to 10 cm. broad, ovate or oval,

Fig. 321.

apex pointed; base rounded or wedge-shaped, margin entire or with a few coarse teeth or lobes, the upper surface smooth, the lower hairy; no odor, taste acrid and astringent.—**C.** Toxicodendric acid (volatile), tannin, etc. By many the irritant principle is said to be a fixed oil; this seems to be incompatible with the fact that some with specially sensitive skins are poisoned without coming into actual contact with the leaves, thus suggesting the volatile principle to be the poisoning agent.—**U.** Irritant and

narcotic; said to have been of benefit in paralysis, chronic rheumatism, etc. Dose: 0.05 to 0.25 gram, best in form of tincture.

Caution: The fresh leaves contain an acrid juice, so that when the leaves are touched intense irritation, blisters, or even suppuration may result. The dried leaves, as generally used for medicinal purposes, are considered inert by many.

Aconiti Folia

N. Aconite Leaves, Monkshood Leaves.—**O.** The leaves of *Aconitum Napellus; Ranunculaceæ.*—**H.** Northern temperate zone.—

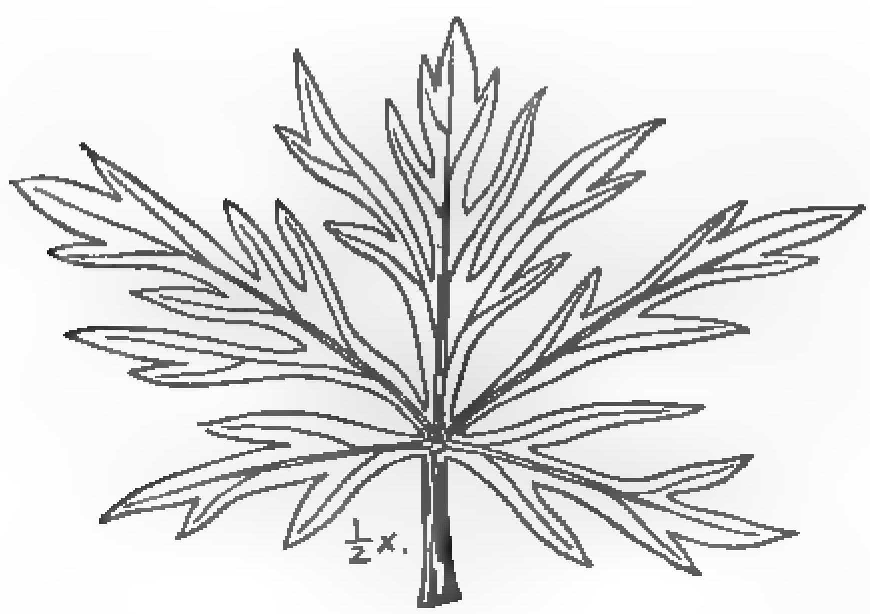


Fig. 322.

D. The illustration gives a good idea of the shape of this leaf; it is one-half natural size. In outline the leaf is round or broadly subcordate, with petiole, palmately three to five-lobed (when three-lobed, the lateral lobes are usually so deeply incised as to make the leaf appear five-lobed), the lobes deeply incised, with the segments lanceolate to wedge-shaped; brownish-green; odor faint, taste acrid, bitter, producing a numbing or tingling sensation in the mouth.—**C.** Aconitine.—**U.** Sedative and motor depressant, in large doses narcotic poison. Similar to Aconite root, but weaker and more variable in strength, so that the preparations of the root ought to be preferred. Dose: 0.05 to 0.20 gram, best in tincture or fluid extract.

Conii Folia

N. Conium Leaves, Hemlock Leaves.—**O.** The leaves of *Conium maculatum; Umbelliferæ.*—**H.** Northern temperate zone.—**D.** The shape is well shown in the drawing; the petioles are hollow and sheathing around the stem; the leaves are up to 30 cm. long, in outline round, ovate or triangularly ovate acuminate, ternately decompound, the pinnæ deeply incised, with the teeth ending in whitish points, smooth upper surface dull bluish-green, lower surface lighter-colored and somewhat glossy; odor and taste dis-

Fig. 323.

agreeably nauseous. The illustration shows the leaf one-third natural size and a lobelet natural size.—**C.** A volatile alkaloid coniine, volatile oil, etc.—**U.** Sedative narcotic, especially of use in the wakefulness of the insane; also frequently added to purgatives to prevent griping. Dose: 0.2 to 0.5 gram, best in form of fluid extract.

This drug is very hygroscopic and therefore liable to become mouldy. It should be kept in a thoroughly dry place; the fresh color is apt to change to yellowish-brown or dirty brown when exposed to moist atmosphere.

The leaves are so variable in strength that the preparations of the fruit should always be preferred; even the latter are very variable in action in different lots, so that great caution should be exercised when prescribing this drug.

In over-doses conium is a narcotic poison, killing by paralysis of the respiratory muscles; antidotal treatment, therefore, resembles that for opium poisoning, emetics, stimulants (alcohol, coffee, nux vomica), enforced exercise, hot applications and electricity.

Ruta

N. Rue, Garden Rue.—**O.** The leaves of *Ruta graveolens; Rutaceæ.*—**H.** Southern Europe.—**D.** The illustration shows the shape

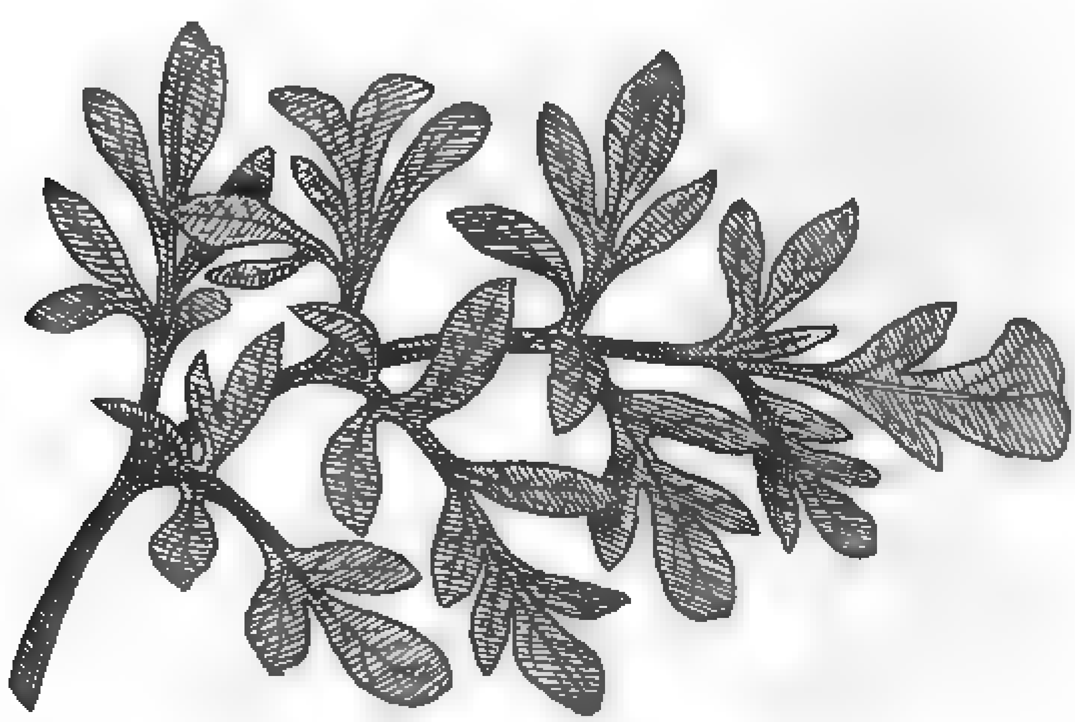


Fig. 324.

of the leaf in natural size; the leaves are somewhat fleshy, twice or thrice pinnatifid, the lobelets about 6 to 12 mm. long, somewhat spatulate or obovate, slightly crenate near the apex, smooth, grayish-green, pellucid-punctate; odor aromatic, balsamic; taste bitter and acrid.—**C.** Volatile oil, resin, etc.—**U.** Stimulant carminative and anthelmintic. In large doses emmenagogue, for which purpose this drug is probably most frequently employed. Dose: 0.5 to 2 grams in infusion.

FLOWERS

The flower is an altered leaf bud and contains the sexual organs which are necessary to produce seed. In pharmacognosy, however, the term "flowers" has a wider meaning, since it includes whole inflorescences, flower-buds, flowers, and parts of flowers. *Inflorescence* signifies the mode of the arrangement of flowers on the plant axis, and in pharmacognosy is used especially in the sense of signifying the peculiar flower-clusters, as racemes, heads, umbels, cymes, etc.; the meaning of these terms is supposed to have been learned from some book on botany.

By the words *simple* or *single flower,* any flower is meant that is not a *compound flower;* it is therefore not meant in the sense of a solitary or axillary flower, but one, a single one, whether it grew singly or solitary, or whether it was gathered from a cluster; in the trade it occurs separate from all other flowers or from any peduncle or axis on which it may have grown.

A *compound flower* is a cluster of flowers, the inflorescence of a plant of the class *Compositæ;* such an inflorescence consists of numerous small flowers gathered into a head which is surrounded by an encircling cluster of leaves which resemble a calyx and which constitute the involucre; the end of the stem is broadened into the receptacle or disc on which are situated the individual flowers, the whole cluster looking like one flower, wherefore it is called a compound flower; as in the sunflower, etc.

Flowers are divided into the following groups:

Flowers	Whole inflorescences	Racemose or cymose		LI
		Compound	Unopened	LII
			Opened	LIII
	Simple flowers	Whole	Unopened	LIV
			Opened	LV
		Parts	Corallas	LVI
			Stigmas	LVII

GROUP LI

Racemose or Cymose Inflorescences

The nature of racemose and cymose inflorescences is supposed to have been learned from some book on botany, but so far as pharmacognosy is concerned, or rather, as far as the method of phar-

macognosy here employed is concerned, we might group inflorescences merely as "compound" and "not compound;" perhaps it might be better to say here, "inflorescences of simple flowers" and "inflorescences of compound flowers." This group comprises the "not compound" inflorescences. By inflorescence we mean those parts of plants which bear the flowers without the ordinary foliage portions being attached; if leafy parts are included regularly with a drug of this general character, it would be a "flowering top," and belong in Group IX.

The umbels of dill, anise, fennel, caraway, parsley, celery, etc., with fruits instead of flowers are to be obtained in the markets as "sweet herbs," for culinary purposes; while at first glance they might be considered to belong here, the fact that they are mature fruits places them elsewhere, and moreover, they do not occur thus in the wholesale drug trade, but are obtained from farmers at the markets or are home-grown.

Large panicles in bundles, rolls or compressed clusters; reddish-brown ....**Cusso.**
Bundles of one-sided racemes with about eight or nine bell-shaped flowers; scape about 15 cm. long........**Convallariæ Flores.**
Heads of small, reddish, papilionaceous flowers, with foliage leaves at base............................**Trifolium.**
Pale yellowish-green bracts with cymes of three to nine flowers ....**Tilia.**
Large corymbose cymes of yellowish color..............**Sambucus.**

Cusso

N. Cusso, Cousso, Kousso, Brayera. The word "Kusso" in its various spellings is indeclinable and neuter.—**O.** The female inflorescence of *Hagenia Abyssinica; Rosaceæ.*—**H.** Abyssinia, Africa.—**D.** Fig. 325 shows a bundle wrapped with the bast of some plant, but many of the bundles of the drug are not so wrapped; the illustration is about three-tenths natural size. The flowers are also figured (Fig. 326); *a*, the section of a flower with fruit partly matured; *b*, pistil; *c*, section of female flower; *d*, male flower, abortive pistils; *e*, female flower, abortive stamens and anthers; *f*, flower-bud of male flower; all much enlarged. The bundles, rolls or compressed clusters consist of panicles about 25 to 40 cm. long, with a sheathing bract at the base of each branch; the drug should consist of tolerably well preserved clusters without

the coarse stems; not of crushed flowers with pieces of the stem; the two roundish bracts at the base of each (female) flower and the five outer, obovate sepals are reddish-brown and membranous; the calyx is cup-shaped and contains two carpels, free from each other, and often partly developed into immature nut-like fruits; the odor, though faint, reminds of elder flowers, and the taste is slight at first, but afterwards becomes bitter and somewhat acrid.—**C.** Kosin about 3 per cent, tannin about 24 per cent, and resin about 6 per cent.—**U.** Anthelmintic, tænicide; not very reliable in action. Dose: 10 to 25 grams, in powder or electuary; or the powder may be made into an infusion with warm water and swallowed without straining.

Fig. 325.

Fig. 326.

The female inflorescence is in bundles of distinctly reddish tint and is known in the trade as "red kousso;" it is the best kind. The bundles of male inflorescence are of a greenish or greenish-brown color and are called "brown kousso" in the trade; they are inferior. The male flowers are frequently added to the female flowers as an adulteration, especially when the drug occurs loose or not in bundles.

Convallariæ Flores

N. Lily of the Valley Flowers, Convallaria Flowers.—**O.** The inflorescence of *Convallaria majalis; Liliaceæ.*—**H.** Europe, North-

ern Asia and America; generally cultivated by florists.—**D.** The flowers occur in the drug trade tied up in bundles just as the gardeners sell the fresh flowers; such bundles are about 2 cm. thick at the lower end, and rather loose or not much compressed at the flowering ends. The one-sided nodding raceme is about

Fig. 327.

15 cm. long and consists of an angular scape, beset with about eight or nine small bell-shaped flowers, white when fresh, but yellowish-brown in the dried drug. Fig. 327 shows the withered raceme of a herbarium specimen in natural size, and one fresh flower, also natural size.—**C.** Convallarin and Convallamarin.—**U.** Similar to those of the rhizome, already described under Group XXII, and which is generally preferred as a drug; heart stimulant. Dose: 1 to 2.5 grams, best in form of fluid extract or infusion.

Trifolium

N. Red Clover, Red Clover Tops.—**O.** The flower-heads of *Trifolium pratense; Papilionaceæ.*—**H.** Cultivated.—**D.** Heads of flow-

Fig. 328.

ers, immediately below which there are two foliage leaves, the stipules of which are winged and enclose the base of the head; the leaves are three-lobed, or frequently one or both of the lower

lobes are absent in one or both of the leaves, so that they may appear to be two-lobed or simple; the head contains from 50 to 150 flowers on a conical rhachis; the flowers are tubular, papilionaceous, purplish-red when fresh, but often brownish-red in the dried drug, fragrant, sweetish. Fig. 328 shows the inflorescence natural size.—**C.** Cumarin, etc.—**U.** Red Clover has been recommended as a remedy for whooping cough; probably of little value. Dose: 5 to 10 grams, in infusion or fluid extract.

Tilia

N. Linden Flowers.—**O.** and **H.** The whole inflorescence, with the bract properly belonging to it, of several varieties of *Tilia*, of which *T. Americana* and *T. heterophylla* are American varieties

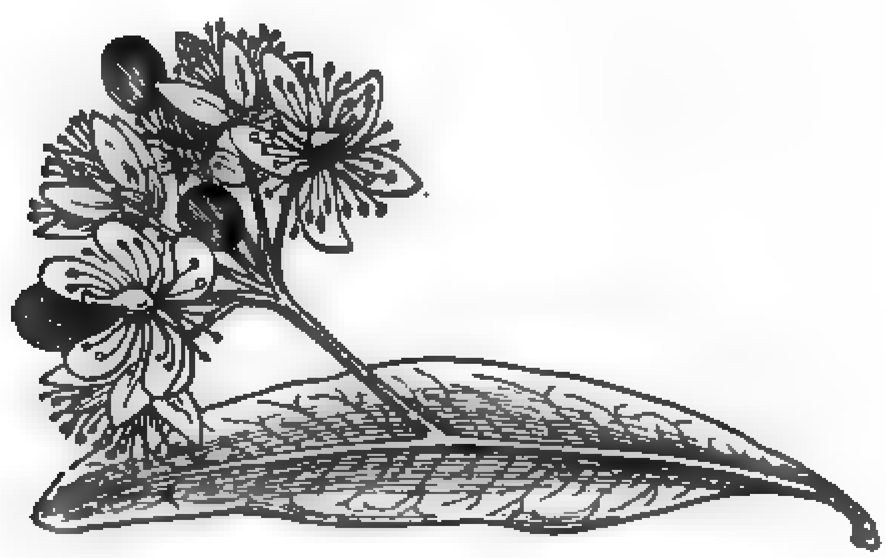


Fig. 329.

and *T. ulmifolia, T. Europea, T. vulgaris, T. parvifolia*, and *T. platyphylla* are European, although *T. ulmifolia* is also cultivated in the United States; *Tiliaceæ*. Most of the drug comes from Germany.—**D.** Fig. 329 shows the inflorescence of *T. ulmifolia* in natural size; the inflorescences of other varieties are similar except that the number of flowers may be different. Linden flowers occur in 3 to 9-flowered racemes, the common stem of which springs from the middle of a bract which is from 5 to 10 cm. long; the flowers are yellowish-white and the thin, membranous, netted-veined bracts are pale green; in the dried state, as drug, the flowers are yellowish, but the bracts should remain greenish and not be brownish; odor pleasant but feeble; taste sweetish.—**C.** Traces of volatile oil and aromatic resin, mucilage,

etc.—**U**. Diaphoretic, in copious draughts of hot infusion; it is probable that the hot water has at least as much to do with the action of these draughts as the linden flowers. Dose: 2 to 5 grams, in infusion.

The whole inflorescence of Sambucus or **Elder Flowers** came into trade formerly, and does so occasionally now; large, corymbose cymes, much branched, often up to 25 cm. across the flattened top, but generally much broken; yellowish. Now the peduncles and pedicels of the inflorescence are usually separated from the flowers and rejected, so that the flowers alone constitute the drug, for which reason this drug will be described under Group LV, opened single flowers.

GROUP LII

Unopened Compound Flower-Heads

Only one drug of this group occurs in our trade, namely, the so-called "Levant Wormseed;" it resembles a seed, so that it is generally called "wormseed," but a careful examination, especially if with a lens, will show the external scales of the involucre.

Elongated, somewhat angular, scaly flower-heads, 2 to 3 mm. long, grayish-green; unopened .... **Santonica.**

Santonica

N. Santonica, Levant Wormseed, Flores Cinæ, Semen Contra.—**O**. The unexpanded flower-heads of *Artemisia pauciflora (Artemisia Cina); Compositæ*.—**H**. Turkestan—**D**. Oblong-ovoid, grayish-green, somewhat glossy flower-heads, about 2 to 3 mm. long, covered with 12 to 18 imbricated glandular scales which enclose 3 to 5 rudimentary or undeveloped florets; odor strong, peculiar, aromatic and slightly camphoraceous; taste bitter, aromatic, leaving a slightly cooling sensation in the mouth.—**C**. Santoninum, volatile oil, etc.—**U**. Anthelmintic, especially for round worms or lumbrici. Dose: 1 to 5 grams, best in form of powder made into an electuary with syrup.

A brownish color indicates that the drug has been exposed to light or is old, the probability being that in either case it has de-

teriorated. It should have a grayish-green color, not brownish-green, and the odor should be strong.

In Fig. 330 *a, b, c, d* show the flower-heads of *Artemisia Vahliana*, whole, in longitudinal section, one scale and one floret; *e* and *f* show the flower-heads of *A. pauciflora (A. maritima; A. Cina)* whole, and one scale showing glands, which in the fresh drug are orange-colored, all much enlarged.

Fig. 330.

Authors differ in regard to the exact source of this drug, and it is probable that the plant may vary under various circumstances, so that the drug may also vary somewhat according to soil, etc. Some authors claim that Santonica is derived from several varieties of *Artemisia*.

GROUP LIII

Expanded Compound Flower-Heads

The nature of compound flower-heads was described on page 381; the group we are now considering includes the expanded compound flower-heads. Occasionally, but rarely, the flowering tops of Matricaria are used instead of the flower-heads alone, and not infrequently the flower-heads alone of Tanacetum occur in the trade, instead of the flowering tops, which were already described in Group IX.

In order to properly examine the drugs of this group, the flower-heads may be soaked in water when they will resume the shape and size of the freshly-flowering inflorescence, and the details of their structure can then be more readily compared with the descriptions and illustrations.

Heads about 3 cm. broad, with scaly involucre, flat receptacle, about 15 to 20 yellow ray-florets and many disk-florets with pappus ....Arnicæ Flores.
Subglobular heads, about 2 cm. broad, with imbricate involucre, conical solid receptacle, numerous white ligulate florets and few disk-florets...........................Anthemis.
Heads about 2 cm. broad, with imbricate involucre, conical hollow receptacle, 12 to 18 white ray-florets and many deep-yellow disk-florets ....Matricaria.
Heads depressed roundish, about 2.5 cm. broad, with imbricate involucre, convex receptacle, about 20 to 30 pinkish ray-florets and numerous yellow disk-florets.............Pyrethri Flores.
Heads sub-globular, about 4 to 8 mm. broad, with imbricate involucre, convex receptacle, and numerous yellow tubular florets ....Tanacetum.

Arnicæ Flores

N. Arnica Flowers.—**O.** The flower-heads of *Arnica montana; Compositæ.*—**H.** Europe and Northern Asia.—**D.** The flower-heads are roundish, about 2 to 3 cm. broad, with double rows of scales in hairy involucre, receptacle nearly flat, small and hairy, with 15 to 20 bright yellow ray-florets and numerous disk-florets; the

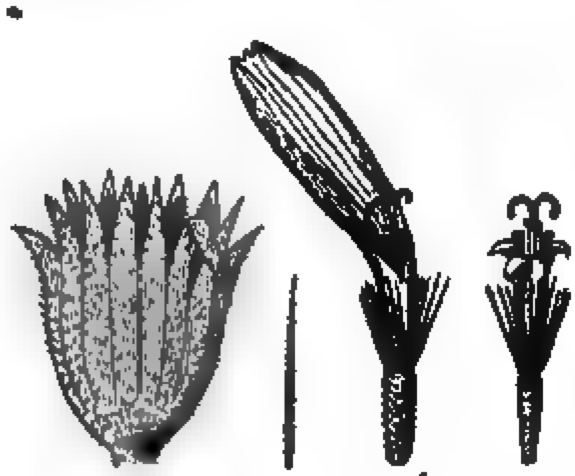


Fig. 331.

ray-florets are female, about 4 cm. long, with tubular part of corolla about 4 mm. long, from which the bifid stigma protrudes, the ligule about 4 to 5 mm. broad, 9-nerved and 3-toothed; the disk-florets are perfect (hermaphrodite), about 2 cm. long, with 5-toothed tubular corolla from which the anther-tube and bifid stigma protrude; in both ray and disk florets, the 4 mm. long ovary (or partially formed fruit, an achene) is surmounted with

a hairy pappus; odor feebly aromatic and taste bitter and acrid.—**C**. Volatile oil, arnicin (nature not determined), resin, tannin, etc.—**U**. Mainly used externally as a vulnerary lotion or dressing; sometimes used internally as a stimulant. Dose: 0.5 to 1 gram, in tincture.

Fig. 331 shows the involucre, ray-floret, disk-floret and pappus hair all in natural size. The drug should be gathered before the fruit commences to develop, as the drug is apt afterwards to contain the larvæ of an insect *(Trypeta)* in the involucre and the more plentiful pappus. The ray-florets should therefore be bright-yellow, not withered and brown, and the drug should not have a gray and hairy appearance from pappus. It is recommended by some authorities that the involucre should always be rejected, because that part of the drug is most apt to contain the insects which are the probable cause of the irritation or urticaria sometimes produced by preparations of this drug; this insect is said to contain a principle similar to cantharidin, and to be the cause of "arnica erysipelas."

Anthemis

N. Anthemis, Chamomile, Roman Chamomile, English Chamomile.—**O**. The flower-heads of *Anthemis nobilis; Compositæ*.—**H**. Cultivated in Europe and in some localities of the United States.—**D**. Subglobular heads about 2 cm. broad, with imbricate involucre, chaffy, conical, solid receptacle and numerous ray-florets with white strap-shaped, 3-toothed corolla, and but few yellow, tubular disk-florets; odor rather agreeably aromatic, taste bitter aromatic.—**C**. Volatile oil, bitter principle, etc.—**U**. Stimulant tonic and carminative; in large doses emetic and emmenagogue (?). Mostly used as a diaphoretic, in copious draughts of hot, but weak infusion, while the patient is covered up in bed; the diaphoretic effect is mainly due to the hot water, though aided by the general relaxation produced by the nauseating effect of the chamomile. Dose: 1 to 5 grams, best in infusion as a tea.

In the wild-growing variety of this plant the flower-heads have only about fifteen ray-florets and many disk-florets; through cultivation the flower-head has become "double," that is, most of

the disk-florets have become changed to ray-florets; the cultivated variety is less disagreeable to the taste than the wild-growing.

Fig. 332 shows a fresh flower-head of the cultivated variety in natural size, but in the drug the ligules are shrunken and doubled over the head so that it looks much smaller; the vertical section of the single or wild flower-head, one ray and one disk floret, stigma and fruit are shown considerably enlarged.

Cotula, the flower-heads or the flowering tops of ***Anthemis Cotula,*** Mayweed, Wild Chamomile or Dog Chamomile (a common

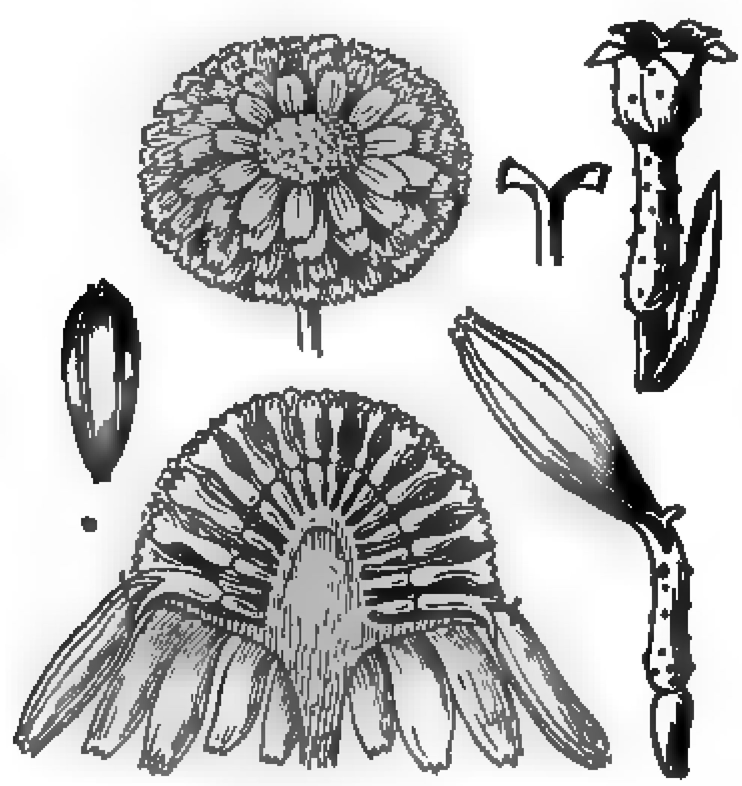


Fig. 332.

weed), are used for the same purposes as ***Anthemis nobilis;*** the taste and odor of Cotula are so disagreeable, however, that it is not a popular drug and is used only when other chamomile cannot be had. The flower-heads of ***Anthemis Cotula*** are single, not double.

Matricaria

N. Chamomile, German Chamomile, Wild Chamomile; this is the drug that is wanted when Germans ask for "chamomile."—**O.** The flower-heads (or sometimes the flowering tops) of ***Matricaria Chamomilla; Compositæ.***—**H.** Europe.—**D.** Heads about 2 cm. broad, with flat imbricate involucre, conical, hollow, naked

receptacle, 12 to 15 female ray-florets about 8 mm. long, with white ligulate, 3-toothed corolla, and numerous perfect (hermaphrodite) tubular disk-florets with yellow, 5-toothed corolla; odor peculiar, somewhat disagreeable and nauseous, taste bitter aromatic.—**C.** Minute quantity of volatile oil, bitter extractive, tannin, etc.—**U.** Same as those of the previous drug, Anthemis.

Owing to the hollow receptacle the flower-heads shrink much on drying and are easily crumbled; a good drug should have whole flower-heads with fresh, bright colors and strong characteristic odor and taste. The hollow receptacle distinguishes this drug from any possible adulteration.

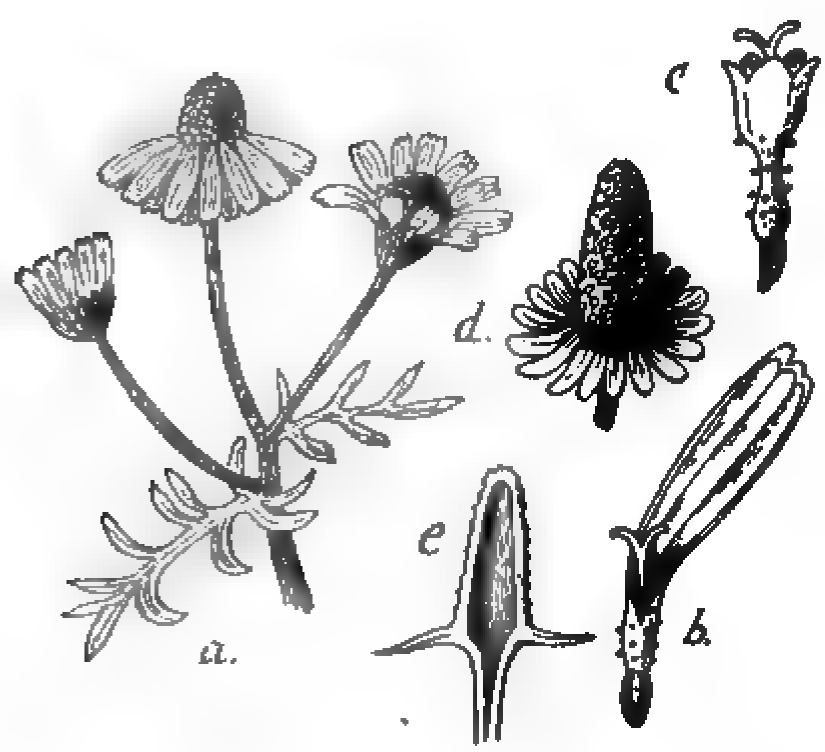


Fig. 333.

Fig. 333 shows a portion of the flowering top with three flower-heads in natural size (fresh, *a*,); the involucre with receptacle (*d*), vertical section of same (*e*), ray-floret (*b*) and disk-floret (*c*) all enlarged.

The flower-heads of several varieties of **Pyrethrum** *(Chrysanthemum)* are imported, but they reach the retail pharmacist only in the shape of "Persian Insect Powder." These flower-heads resemble in shape those of Anthemis, but the involucres are usually marked with red to brown markings, and the ray-florets are pinkish to reddish. The drug is of no particular interest in its whole condition to the pharmacist.

Tanacetum, the flowering tops (or occasionally the flower-heads) of *Tanacetum vulgare*, has already been described and figured under Group IX, but as the drug sometimes consists of the flower-heads alone it is also mentioned here.

GROUP LIV

Unopened Single Flowers

Only two drugs consisting of unexpanded buds (Latin: *Alabastri)* of single flowers are of sufficient importance to need mention here:

Subcylindrical calyx tube with four teeth, terminated by a corolla forming a globular head; about 15 mm. long; brown .... **Caryophyllus.**
Ovoid buds, about 12 to 15 mm. long, with 5-toothed calyx; pale brownish-yellow .... **Aurantii Flores.**

Caryophyllus

N. Cloves.—**O.** The unopened flower-buds (unexpanded flowers) of *Eugenia aromatica; Myrtaceæ.*—**H.** Molucca Islands; cultivated in tropical regions of the Eastern continent.—**D.** About 15 to 18 mm. long and 4 to 5 mm. thick through thickest part; dark brown, with a subcylindrical calyx tube which at its upper end is divided into four spreading notches or sepals supporting four petals which overlap each other and form a globular head (bud) covering numerous curved stamens and one style; the calyx tube contains the ovaries in its upper part and throughout its entire length contains near its outer surface many small intercellular gland-spaces or oil-glands; the odor is strongly aromatic and the taste pungent and spicy.—**C.** The only constituent of value is the volatile oil, which is so abundant (15 to 20 per cent) that it exudes simply on pressure of the surface of the clove with the finger-nail.—**U.** Spice and condiment. Stimulant, carminative and stomachic. Dose: 1 to 2 grams in infusion.

Fig. 334 shows a whole clove (*a*) and a fruit (*b*) in natural size; also a clove with petals removed (*c*) and a vertical section of a clove (*d*), both enlarged.

The unripe fruits of the clove tree come into the trade under the

name of "mother-cloves" or "*anthophylli;*" they are much less aromatic than cloves, and are mainly used to adulterate the latter when powdered.

Cloves, to be good, must be plump, heavy, of rich brown color, strong spicy odor and pungent aromatic taste; they should be

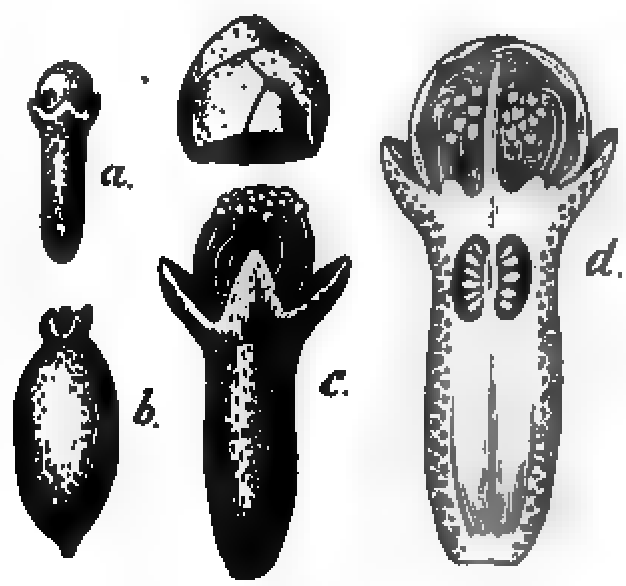


Fig. 334.

kept in well-closed vessels. Occasionally cloves are mixed with some from which the volatile oil has been abstracted by distillation; such cloves are much shrunken, appear to be moist, are dark-colored or almost black and the heads formed by the petals are generally broken or missing; they are, of course, much weaker in odor and taste.

Aurantii Flores

N. Orange Flowers; *Flores Naphæ.*—**O.** The unopened flower-buds (unexpanded flowers) of *Citrus vulgaris* and *C. Aurantium; Rutaceæ (Aurantiaceæ).*—**H.** Cultivated in all subtropical countries.—**D.** About 15 mm. long without the flower-stalk which is often present; the calyx is cup-shaped, small and 5-notched and incloses the base of the corolla which consists of five over-lapping pale brownish-yellow petals forming an ovoid head (bud) covering numerous polyadelphous stamens inserted on a disk around a pistil with a globular ovary and stigma; odor fragrant and taste aromatic bitter.—**C.** Volatile oil (oil of neroli) and bitter extractive.—**U.** Slightly stimulant and antispasmodic (?), but not much used.

Fig. 335 shows the whole bud and the expanded flower in natural size; also the bud with petals removed, showing stamens surrounding the pistil, and the same with the stamens removed, the latter two illustrations enlarged.

The fresh flowers are used for making the distilled water of

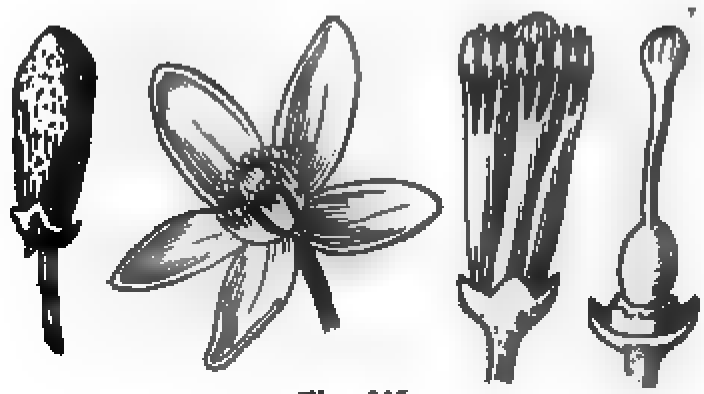


Fig. 335.

orange flowers; sometimes the fresh flowers are salted down in jars with about one-third of their weight of salt, and distilled water may be made from these. The dried flowers which constitute the drug described above are practically worthless; the dried flowers should be rejected if they are not strongly fragrant or if they are of a decidedly brown color.

GROUP LV

Opened Single Flowers

Under this group we find single simple flowers as well as single florets from compound flowers; the characteristic being that the flowers are entire. When a drug consists only of parts of flowers it belongs in Group LVI or LVII. Flowers can best be examined by first soaking in water, by which they to a certain extent resume their fresh shape and allow dissecting, to demonstrate botanical details.

Simple Flowers:

Small shriveled, pale brownish-yellow, roundish grains.... **Sambucus.**

Small two-lipped flowers with bluish-gray calyx and violet-blue corolla .... **Lavandula.**

Light grayish-green, double calyx, felty with stellate hairs; petals purplish-black .... **Althææ Flores.**

Similar to last, somewhat smaller, and the corolla bluish-purple in dry drug .... **Malvæ Flores.**

Florets from Compound Flowers:

Yellow, strap-shaped, fertile (female), ray-florets .... **Calendula.**

Deep-red, thin tubular, 5-lobed corolla, with projecting anther tube and style .... **Carthamus.**

Neuter (sexless) florets, with tubular corolla ending in 7-parted blue limb .... **Cyani Flores.**

Calyx grayish-green, felty, 5-parted; corolla 5-lobed, wheel-shaped, yellow .... **Verbasci Flores.**

Sambucus

N. Elder Flowers.—**O.** The flowers of *Sambucus Canadensis* and *S. nigra; Caprifoliaceæ.*—**H.** *S. nigra* is preferred in Europe and England because it grows there, and *S. Canadensis* is preferred in America because it is indigenous here; there is no need

Fig. 336.

to distinguish between the two kinds as they are practically alike in appearance and in medicinal value.—**D.** In the dried drug the flowers are shriveled into roundish grains or balls scarcely more than 1½ to 2 mm. in diameter, pale brownish-yellow, with a peculiar fragrant odor and a sweetish, mucilaginous aromatic and finally somewhat acrid taste. By soaking in water the flowers may be recognized as such and can be more readily examined. The fresh flowers are about 5 mm. broad, calyx superior and minutely 5-toothed, corolla 5-lobed, wheel-shaped, cream-colored or white, with five extrorse stamens, pistil with three roundish stigmas; Fig. 336 shows upper surface of flower enlarged (*a*), under surface of flower enlarged (*b*), from side, corolla and stamens removed (*c*), and flower in natural size (*d*).—**C.** Very small quantity of volatile oil, resin, tannin, etc.—**U.** Stimulant diaphoretic. Dose: 2 to 4 grams, best in infusion.

Lavandula

N. Lavender, Lavender Flowers.—**O.** The flowers of *Lavandula vera; Labiatæ*.—*H.* Cultivated in Europe and America.—*D.* Small blue flowers, about 12 mm. long, calyx tubular, 5-toothed, the tooth on the back of the flower larger than the others and roundish, calyx bluish-gray, hairy, the corolla violet-blue, labiate, the upper lip obcordate, larger and 2-lobed, the lower lip smaller and

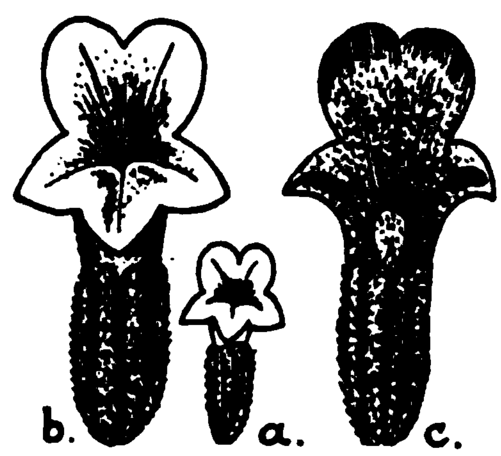


Fig. 337.

3-lobed, hairy-glandular on outer surface, four stamens on inside of tube; fragrant odor and aromatic, camphoraceous and bitterish taste. Fig. 337 shows a flower in natural size (*a*), same enlarged, front (*b*) and back (*c*).—**C.** One to three per cent of volatile oil, resin, etc.—**U.** Stimulant carminative. Rarely used internally, except as a flavoring agent; the whole flowers are often used as sachet perfume.

Althææ Flores

N. Flores Malvæ Arboreæ, Mallow Flowers, Hollyhock flowers; see Fig. 338.—**O.** The flowers of *Althæa rosea; Malvaceæ*.—**H.** Cultivated; in cultivation the flowers are often double.—**D.** The flowers of this plant vary in color, white, yellow, rose, red, brown to purplish-red and purplish-black, but only the dark-colored flowers are gathered for the trade. Hollyhock flowers are 7 to 10 cm. broad, calyx gray-felty with stellate hairs, double, the outer layer of sepals (also called involucre) 9-cleft, the inner layer 5-cleft, corolla 5-lobed, the petals broadly obovate, notched at apex, united at base to the base of a column or tube formed by the union of the numerous filaments bearing many kidney-shaped anthers, and within which tube are the stigmas; odor slight, taste sweetish mucilaginous and slightly astringent. The illustration shows the

upper surface of a flower, natural size; the column bearing anthers is shown.—**C.** Mucilage, tannin, etc.—**U.** Demulcent, emollient. Used as an ingredient of "species pectorales."

The infusion of the petals is rendered red by acids, green by alkalies. The petals are also brought into trade alone, as corollas, and can be used as a rich and harmless coloring agent for artificial fruit syrups, etc.

Malvæ Flores, Mallow Flowers, slightly smaller than those from ***Althæa rosea,*** are obtained from ***Malva sylvestris, M. rotundifolia,*** etc. The flowers of these plants are similar to the above, ex-

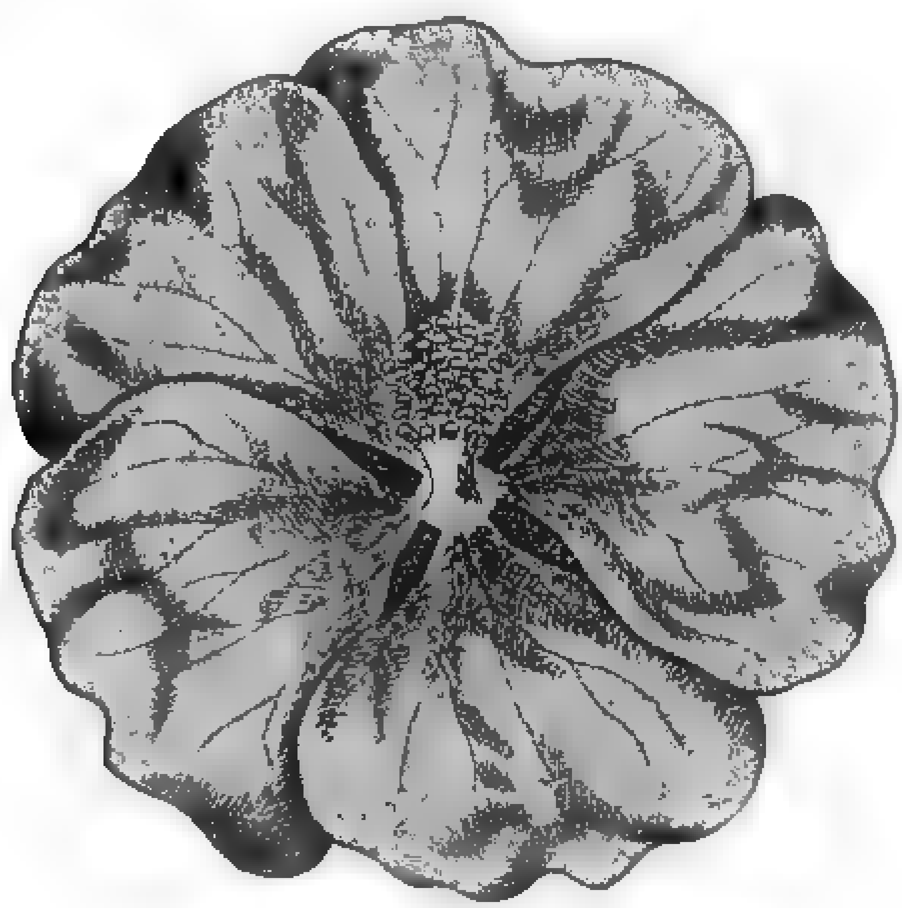


Fig. 338.

cept that the petals have a bluish-purple color when dry, as in the drug. European writers (Schleiden, Berg, etc.) include under the title "Flores Malvæ Arboreæ" the flowers of ***Althæa rosea, A. officinalis, Malva sylvestris, M. rotundifolia, M. neglecta,*** etc., so that it is probable that no accurate distinctions need be made in the drugs known in the trade as "flores althææ" or "flores malvæ."

These flowers vary in size and color, and to a limited extent in other regards, but resemble the illustration closely enough for identification; they all have the central column hollow stamen-tube with numerous anthers.

They are all used for the same purposes as the **Flores Althææ** described above.

Calendula

N. Calendula Flowers, Marigold Flowers.—**O.** The ray-florets of *Calendula officinalis; Compositæ*.—**H.** Cultivated everywhere.—**D.** Occasionally the flowering tops are used. The plant has a rough, angular stem, alternate, thick, hairy, spatulate leaves; flower-heads about 5 cm. broad, with conspicuous bright orange-yellow florets. Generally, however, only the ray-florets are gathered. The ray-florets are fertile (female), have a slightly curved ovary and a ligulate corolla, bright orange-yellow, up to

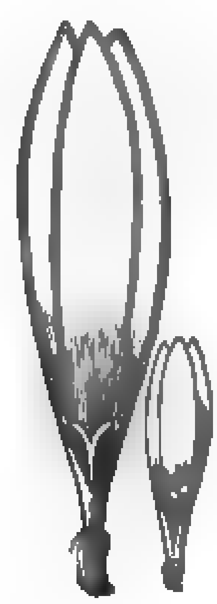


Fig. 339.

2.5 cm. long and 3 mm, wide, 3-toothed and delicately striate longitudinally, the bifid style projecting from the short tube of the corolla; there is no pappus, by which characteristic calendula flowers may be readily distinguished from arnica flowers or other similar flowers. Fig. 339 shows a ray-floret in natural size, and enlarged.—**C.** An amorphous bitter principle, traces of volatile oil, yellow coloring principle, etc.—**U.** Reputed to possess tonic, antispasmodic, diaphoretic and emmenagogue properties. Used also as a vulnerary externally, for similar purposes as arnica, to which drug it is probably superior, because less apt to be infested with insects and therefore less likely to produce the trouble which is usually called "arnica urticaria" or "arnica erysipelas." **Dose:** 0.5 to 1 gram in infusion.

Carthamus

N. Safflower, American Saffron.—**O.** The florets of *Carthamus tinctorius; Compositæ.*—**H.** Cultivated in India, the Levant and Egypt, Asia, Europe and America.—**D.** Fig. 340 shows a floret in natural size; the compound flower-heads are large and the florets are yellow, but after fertilization when the corollas commence to wither, the florets change to a deep orange-red color; it is at this time that the florets are gathered by plucking from the flower-heads. The floret consists of a very thin cylindrical tube, about 2.5 cm. long, ending in a 5-cleft limb, each lobe of which is about 4 to 6 mm. long; from this tube projects the syngenesious anther-

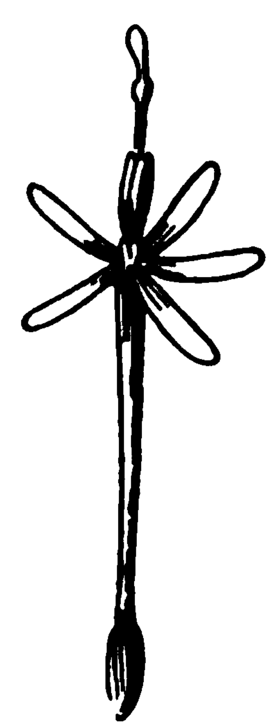


Fig. 340.

tube, yellow, and also about 4 to 6 mm. long, and through the latter the stigma protrudes another 6 mm., so that the total length of the floret is about 40 mm., but that of the corolla alone only about 2.5 cm.; odor feeble, peculiar, taste insipid, faintly bitterish.—**C.** Carthamin, about 40 per cent yellow coloring principle, etc.—**U.** Diaphoretic in infusion. Dose: 2 to 5 grams. Mainly used as a coloring agent, or as a cheap substitute for genuine saffron; this drug is sometimes called "false saffron."

The Oriental or Indian varieties of this drug are most highly esteemed and in the best grades of this drug the corolla was picked from the ovary in the gathering, so that the ovary is missing; see next group.

Cyani Flores

N. Only used by German pharmacists, to whom it is known as "Korn-Blume" or corn-flower.—**O.** The ray-floret of *Centaurea Cyanus; Compositæ.*—**H.** A common weed in European grain ("Korn") fields.—**D.** The ray-florets (Fig. 341) are neuter or sexless, about 3 cm. long, corolla consisting of a thin tube expanding into a cup-shaped, irregularly 7-cleft limb, of a blue color. See illustration, natural size. The flowers must be dried quickly and kept in a dry and dark place as they otherwise bleach readily.—**C.** Mucilage, etc.—**U.** German pharmacists are fond of giving a peculiar mottled appearance to their preparations of "species pectorales" and they use for this purpose such inert substances as possess pronounced bright colors: *Flores*

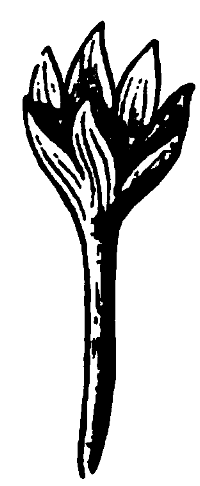


Fig. 341.

Cyani, flores malvæ, flores verbasci, etc. Flores Cyani have no medicinal virtues.

Verbasci Flores, Mullein Flowers, are sometimes gathered entire, but usually the drug consists of the corollas alone, wherefore the description of this drug is to be found in the next group.

GROUP LVI

Cololla𝑠

This group includes only the corollas, either entire as in *Verbasci Flores,* or the separate petals (Latin: *Petala)* as in *Rosa centifolia. Flores Cyani,* consisting of neuter florets, have the appearance of corollas only, although they are really entire florets; they may therefore be looked for here and are mentioned for this reason in this group. Safflower, already mentioned in the last

group, is sometimes gathered by pinching off the corolla, rejecting the ovary, so that the drug does not consist of entire flowers but only of parts of flowers; however, the corolla with the stamens and style projecting look so much like an entire flower, that the drug would still probably be looked for in the previous group. Mullein flowers usually consist only of the corolla with inclosed adherent stamens; they would therefore probably be looked for here, but because the whole flowers are sometimes found in the trade, they are also mentioned under Group LV.

Roundish-obovate or obcordate petals of pinkish color and fragrant odor .... **Rosa Centifolia.**
Deep purplish-red cones, about 2.5 cm. long, consisting of imbricated roundish petals......................... **Rosa Gallica.**
Five-lobed, wheel-shaped, hairy, yellow corolla, with five coherent anthers enclosed........................... **Verbasci Flores.**
Nearly round, thin, dark-red petals, about 5 cm. broad, with a blue-black spot at the base.................. **Rhœadis Flores.**
Five obovate-cuneate, deep-red to purplish-black petals, each about 2.5 to 4 cm. long, united at the base.......... **Althææ Flores.**
Similar to last, but smaller and bluish-purple.............. **Malvæ Flores.**
Deep-red, thin tubular, 5-lobed corolla, with projecting anther tube and style................................ **Carthamus.**
Neuter (sexless) florets, with tubular corolla ending in 7-parted blue limb.................................... **Cyani Flores.**

Rosa Centifolia

N. Pale Rose, Pale Rose Leaves, Rose Leaves.—**O.** The petals of *Rosa centifolia; Rosaceæ.*—**H.** Western Asia, but now cultivated

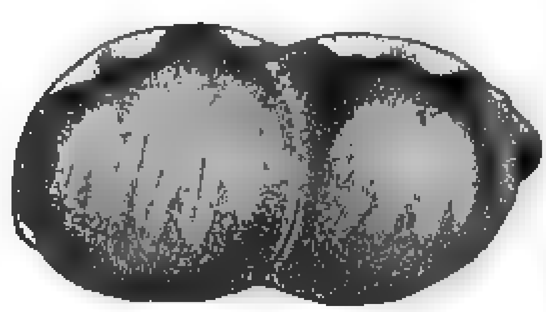


Fig. 342.

everywhere.—**D.** Cultivated roses are double flowers having many petals; the pale-red petals of the variety under consideration are ovate, roundish, broader than long, notched at apex so as

to appear almost obcordate, the upper margin often recurved; Fig. 342 shows one of the larger outer petals as it appears when fresh; if carefully dried the petals retain their shapes and fresh color fairly well, but exposure to light is apt to change the delicate pink color to a pale brownish-yellow; odor fragrant, taste slightly astringent.—**C.** Traces of volatile oil, tannin, etc.—**U.** For flavoring. Sometimes preserved undried with one-half of its weight of salt by packing tightly in jars; these leaves may then be used for making rose water by distillation, but the latter can be bought so much better and more economically that probably very few pharmacists would take the trouble to make their rose water from salted leaves.

Rosa Gallica

N. Red Rose.—**O.** The petals of the unopened buds of *Rosa Gallica; Rosaceæ.*—**H.** Southern and middle Europe, eastward to Cau-

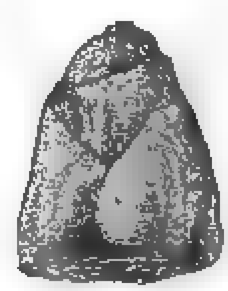


Fig. 343.

casia; now cultivated everywhere.—**D.** The petals are removed from the unexpanded bud without separating them, and then quickly dried, so that the drug consists of small cones, varying somewhat in size, each cone consisting of numerous imbricated, roundish, notched, deep-purplish-red petals (see Fig. 343); the yellow claws or bases of the petals should be cut away when the drug is gathered, but are frequently allowed to remain; odor fragrant, taste slightly astringent.—**C.** Traces of volatile oil, tannin, etc.—**U.** Mainly for flavoring.

Verbasci Flores

N. Mullein Flowers.—**O.** and **H.** The corollas (with stamens), or more rarely the entire flowers of several varieties of *Verbas-*

cum; the common mullein of America is *Verbascum thapsus; Scrophulariaceæ.* The two varieties *V. thapsiforme* and *V. phlomoides* are common weeds in Europe, where *V. thapsus* also occurs. All three varieties furnish the drug, although *V. thapsiforme* has the largest flower and therefore furnishes the showiest drug.—**D.** Fig. 344 shows the corolla of *V. thapsiforme* laid open to show the stamens. The hairy 5-lobed calyx is generally absent in the drug; the corolla is rotate or wheel-shaped, 2 to 4 cm. broad, bright golden yellow, with five roundish lobes, and with five stamens inserted in the tube of the corolla, three of which are shorter and woolly and two longer and naked; odor faintly aromatic and taste sweetish mucilaginous. The corollas of the American variety, *V. thapsus,* are similar but smaller, being only about 15

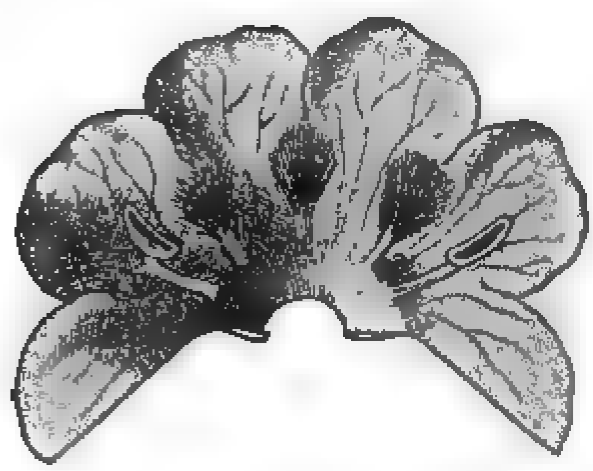


Fig. 344.

mm. in diameter.—**C.** Trace of volatile oil, a fatty substance, mucilage, etc.—**U.** Demulcent; used mainly as a showily colored ingredient of pectoral teas.

Flores Rhœadis

N. Poppy Flowers.—**O.** The petals of *Papaver Rhæas; Papaveraceæ.*—**H.** A European annual, but generally cultivated as a showy garden flower.—**D.** The entire flower is shown in Fig. 345 in natural size; the petals are very thin and delicate, broadly oval, broader than long, dark-red, with a blue-black spot at the base where they are inserted on the receptacle (hidden in the flower by the stamens and pistil); odor faintly narcotic, taste

bitterish mucilaginous. In the drug the petals are much shrunken.—**C.** A deep-red coloring principle, rhœadic acid, solu-

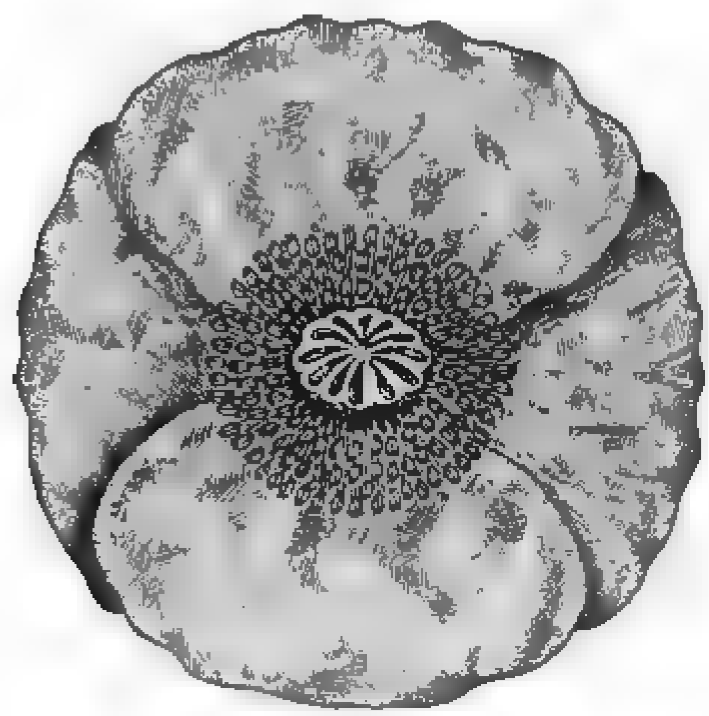


Fig. 345.

ble in water and in dilute alcohol, etc.—**U.** Coloring agent; used like Flores Malvæ.

For description of **Flores Althææ, Flores Malvæ, Carthamus** and **Flores Cyani,** see previous group.

GROUP LVII

Stigmas

The group includes two drugs only; these drugs consist of the styles and stigmas of the plants from which they are derived, the stigmas being the important part in Crocus and the styles in Zea. The group is called "Sexual Organs" by some authors, but this is evidently wrong because only parts, and not even the essential parts, of only the female organs are present; and moreover, there would be just as much reason to call Flores Verbasci "Corollas with Sexual Parts" as to call these drugs "Sexual Parts." The group has also been called "Styles with Stigmas," but as in the Latin titles for these drugs, as used in different works, the word "Stigmata" has so long been used it is deemed inadvisable to

change the custom, and this word is therefore preferred as the most appropriate title for this group of drugs.

Separate stigmas, or three attached to a style, linear tubular, about 3 cm. long, deep orange-brown with reddish tinge..............**Crocus.**
Tufts of soft, silky, thread-like, yellowish hairs, about 15 cm. long; the ends of the tufts often dried or shriveled together and dark brown ....**Zea.**

Crocus

N. Saffron, Spanish Saffron, True Saffron.—**O.** The stigmas of *Crocus sativus; Iridaceæ.*—**H.** Cultivated in Asia Minor and in Southern Europe; most of the saffron sold in this country is

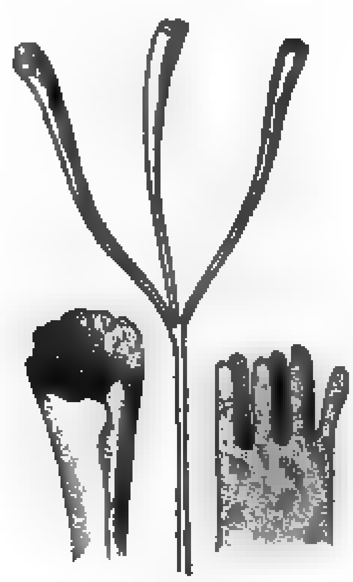


Fig. 346.

from Spain and France.—**D.** The illustration shows the stigmas in natural size, with a short piece of the style attached, but in the drug they are crumpled and shrunken; also, on the left, the end enlarged and on the right a portion of the margin, very much magnified. To examine the drug, drop a few shreds on warm water, when it will regain its fresh form. The stigmas are usually gathered so that a small portion of the style remains attached, and the three stigmas of a flower thereby remain attached as in Fig. 346; but occasionally they are pinched off shorter and are then single stigmas; the drug should contain very little of the styles. The stigma is about 3 cm. long, flattish-tubular, almost thread-like where it joins the style, broader and split on the inner side of the free end, which is notched and shows papillose margin under a lens; a good grade of saffron is of

a rich orange-brown color with reddish tinge, somewhat deeper at the end and lighter toward the style, flexible and soft, not dry and hard, with a peculiar strong odor and an aromatic bitterish taste, and when chewed it stains the saliva a deep golden yellow.—**C.** Coloring matter, gum, wax, etc.—**U.** Seldom employed otherwise than as a coloring agent. It is mildly diaphoretic, slightly sedative and antispasmodic. Dose: 0.3 to 2 grams, in infusion or tincture.

The genuine drug is necessarily very high-priced as the stigmas from 130,000 flowers must be picked to make one kilo of the drug; owing to this high price the drug is often adulterated, or cheaper substances bearing more or less resemblance to it are used as substitutes or admixtures.

The ray-florets of Calendula, flowers of Carthamus, petals of pomegranate or other deep-red flowers cut in shreds, shreds of smoked or dried beef, and other similar substances are readily distinguished when the suspected drug is placed on warm water, which causes the different parts to spread out and show their shapes.

The stigmas of some other varieties of Crocus are occasionally added; they are smaller, more flaring and more deeply notched at the upper ends, and have a yellowish color.

A deceptive adulteration is the addition of true saffron from which the coloring matter has been extracted by maceration; the exhausted stigmas have a pale and uniform yellowish color, and the whole drug has a less rich and bright appearance.

It is sometimes loaded with mineral matters to increase the weight; when soaked in water this pulverulent substance is deposited.

Although saffron feels greasy to the touch, it does not contain fixed oil. It should not leave a greasy spot when pressed between two thicknesses of filter-paper.

On drying saffron it should not lose more than fourteen per cent of moisture (showing absence of water fraudulently added) and when thus dried it should not leave more than 7.5 to eight per cent ash on burning (absence of foreign mineral substances).

Saffron bleaches in the light and loses its odor when exposed to the air; it should therefore be kept in well-closed opaque containers, or in a dark closet, in a cool place.

Zea

N. Corn-silk.—**O.** The styles and stigmas of *Zea Mays; Gramineæ.*—**H.** Indigenous to the tropical parts of America, but now cultivated in all tropical and sub-tropical parts of America and in some few places on the other continent.—**D.** Corn-silk consists of the threads projecting from the ears of corn, and is gathered when the corn is "shucked" or "husked;" the projecting ends of the styles are darker-colored, brownish to almost black, matted and tangled so that the threads are held together in tufts or bundles, the threads of which, where they were covered by the

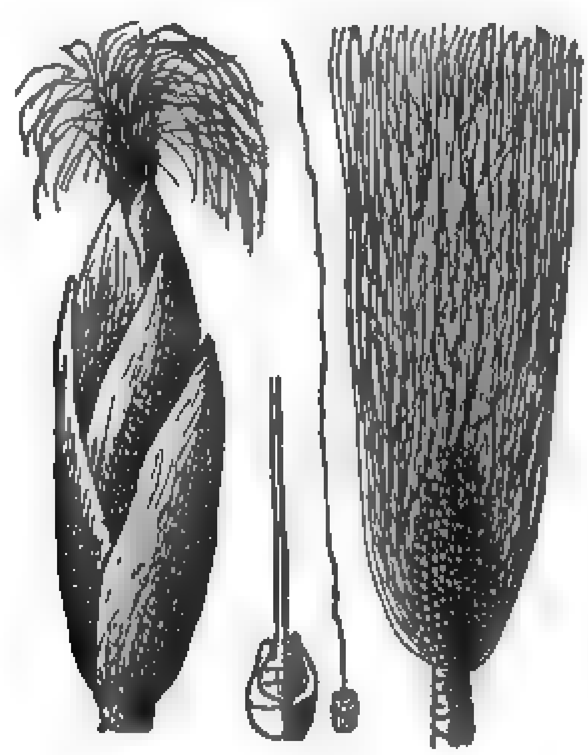


Fig. 347.

"shucks" are pale yellowish or yellowish-green, about 15 cm. long, fine silky hairy and delicately veined longitudinally; without odor, taste sweetish.—**C.** Sugar, mucilage, etc.—**U.** Reputed to be diuretic, nephritic and lithontriptic. Useful in cystitis from any cause. Dose: 2 to 10 grams, in infusion or fluid extract.

The drawing on the left (Fig. 347) shows the "ear" of corn, a spadix surrounded by spathes that form the "shucks" when mature, and from the ends of which the long styles with their stigmas project; the right hand figure shows the spadix with its female flowers and the styles and stigmas, while the two small figures show single female flowers, one enlarged; both the larger figures are much smaller than in nature.

FRUITS

This group includes not only whole fruits, but parts of fruits as well. In the trade the terms "fruits" and "seeds" have not been sufficiently accurately differentiated, as many drugs are called "seeds" which in reality are fruits, as for instance, "anise seed," "caraway seed," etc. In pharmacognosy such inaccuracies are not permissible, and the student should make an effort to learn as soon as possible to use scientific words only in their correct meaning.

Strictly speaking, a fruit is the ripened ovary with all that it contains; this may be thought of as a "true fruit" to distinguish it, for purposes of pharmacognosy, from "spurious fruits." It is common to call the matured ovary with all that is attached to it a fruit, although in some fruits of this kind the bulk of the fruit may thus be formed by a calyx tube that was adherent to the ovary, as in the apple, or of woody or leathery scales that were not part of the flower at all, as in cones and strobiles, or of the thickened end of the stem, or receptacle, as in the strawberry or fig; such a structure is a "spurious fruit" and the true fruits may be enclosed within, as in rose hips or figs, or they may be on the outside, as in the strawberry.

Fruits are divided into three groups: *Fleshy Fruits,* in which the seeds are inclosed in a more or less soft and juicy flesh; *Stone Fruits* or *Drupes,* in which the outer part (under leaf surface) of the ovary becomes soft and fleshy and the inner part (upper leaf surface) of the ovary hardens into a stony shell which envelopes the seed, like a nut; and *Dry Fruits,* having no fleshy part at all, the entire ovary hardening into a stony, leathery, hard or tough structure which envelopes the seeds and in some kinds becomes permanently united to the outer seed coat, while in other kinds the ovary opens or dehisces and allows the seeds to fall out.

Fruits may be further divided into *Simple Fruits,* when a single pistil of a single flower developes into one fruit, and *compound Fruits* (also called *multiple* or *collective*) when a large number of pistils of one flower produce a cluster of fruits, as in raspberry, or when a number of single flowers develop so that the fruits are united into apparently one fruit, as in mulberry.

Some authors make a distinction between different kinds of com-

pound fruits, thus: An *Aggregate Fruit* is one in which the individual fruits were all developed from the carpels of the same flower, while a compound fruit resulting from a consolidation of the carpels of several or many flowers is called a *Collective* or *Compound Fruit*.

Fruits which are not used to make medicinal preparations, or which are not recognized in some pharmacopœia or other, but which are only used for making "crushed fruits" or "fruit syrups" for the soda water fountain, or for similar purposes, as strawberry, blackberry, cherry, grape, pineapple etc., are not drugs and therefore are not described in this book.

Fruits	Fresh	Spurious	LVIII
		Fleshy	LIX
		Stone Fruits	LX
	Dried or prepared	Spurious	LXI
		Dry	LXII
		Fleshy	LXIII
		Stone Fruits	LXIV
	Parts of Fruits		LXV

GROUP LVIII

Fresh Spurious Fruits

The fruits of this group are seldom employed, partly perhaps because one of them is not easily obtainable, and the preparations made from them are not often prescribed.

The *pome* is a fruit in which the fleshy mass, which constitutes the principal thickness, is formed by development of the calyx, as in the apple, pear and quince.

Pitcher-shaped or ovate berry-like fruit, about 2 cm. long, bright glossy red, bristly hairy within .... **Rosa Canina.**

Globular or subglobular pome; green, russet, yellow, red or varicolored; acidulous sweet .... **Malum.**

Rosa Canina

N. *Cynosbata,* Rose Hips, Hips.—**O.** The spurious fruit of *Rosa canina; Rosaceæ.*—**H.** Europe.—**D.** Pitcher-shaped or ovate re-

ceptacle, about 2 cm. long, bright glossy red, fleshy, inclosing a number of brown dry fruits or akenes with bristly hairs; odor slight and taste sweetish acidulous; see Fig. 348.—**C.** Malic acid,

Fig. 348.

citric acid, sugar, gum, etc.—**U.** Mild refrigerant; when used, the interior akenes and hairs are first removed.

Malum

N. *Fructus Mali, Pomum,* Apple.—**O.** The fruit of *Pyrus Malus; Rosaceæ.*—**H.** Cultivated in temperate zones.—**D.** Fig. 349 shows a longitudinal and a transverse section of an apple, to explain structure. The apple consists of five leathery carpels each enclosing several seeds, arranged in a stellate manner, forming the "core" of the apple (or the true fruits), and surrounded by a

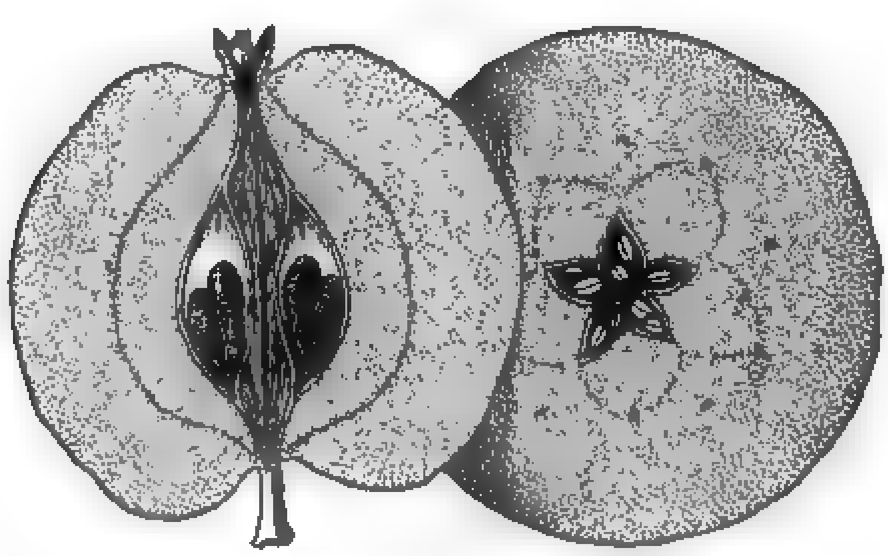


Fig. 349.

large fleshy mass which is the developed calyx; there are many varieties of apple in cultivation, varying in color and flavor, green, russet, yellow, red, striated, varicolored, and from very

sweet and mealy to sour and juicy; for medicinal use only a sour and juicy apple is available. —**C.** Fruit acids (malic, etc.), sugar, etc.—**U.** The only medicinal use made of the apple is in preparing *Extractum ferri pomatum* (from which in turn *Tinctura ferri pomata* is made; the word *pomatus, a, um* being a Latin adjective meaning "made from apples"); cider made from sour apples is poured over iron filings in a stone jar and after fermentation and maceration the liquid is decanted and evaporated to solid extract consistence. This preparation is tolerated by the most sensitive stomachs, and is a chalybeate preparation that deserves more consideration at the hands of American physicians than it is receiving.

GROUP LIX

Fresh Fleshy Fruits

Fleshy fruits are also called *berries;* this group therefore comprises the berries which are used in the fresh condition. Berries proper are fleshy throughout; the lemon and orange are berries with leathery rind; a *gourd* is a berry with a hard rind, and a *pome* is a fleshy fruit resembling a berry, but formed mainly of a fleshy calyx, as the apple, etc.; therefore the pome is really a spurious fruit, but because the apple would likely be looked for in this group it is also mentioned here. (See previous group.)

The raspberry is usually called a berry, but is really an aggregate or multiple fruit, each little fruit being a drupe, similar in structure to a plum, although of course much smaller. See next group for description.

Oval, bright yellow fruits, with very acid juice............**Limon.**
Globular or subglobular, orange-colored fruits, with acidulous sweet juice....................................**Aurantii Fructus.**
Globular green berry, about 2.5 cm. in diameter, with 4-lobed persistent calyx and about five seeds............**Diospyros.**
Globular or subglobular pome; green, russet, yellow, red or varicolored; acidulous sweet........................**Malum.**
A collective or multiple fruit, composed of numerous small drupes; red or black................................**Rubus Idæus.**
Small round fruit resembling a berry, about 5 mm. in diameter, brownish-black with bluish bloom.............**Juniperus.**

Limon

N. ***Fructus Citri;*** Lemon.—**O.** The fresh fruit of ***Citrus Medica Limonum; Rutaceæ (Aurantiaceæ).***—**H.** Cultivated in sub-tropical countries.—**D.** Fig. 350 shows the fruit in natural size; oval, with nipple-shaped apex, glandulous bright-yellow ("lemon-yellow") rind; contains an agreeably acid juice. The section of the lemon closely resembles that of the orange (see next figure), but the

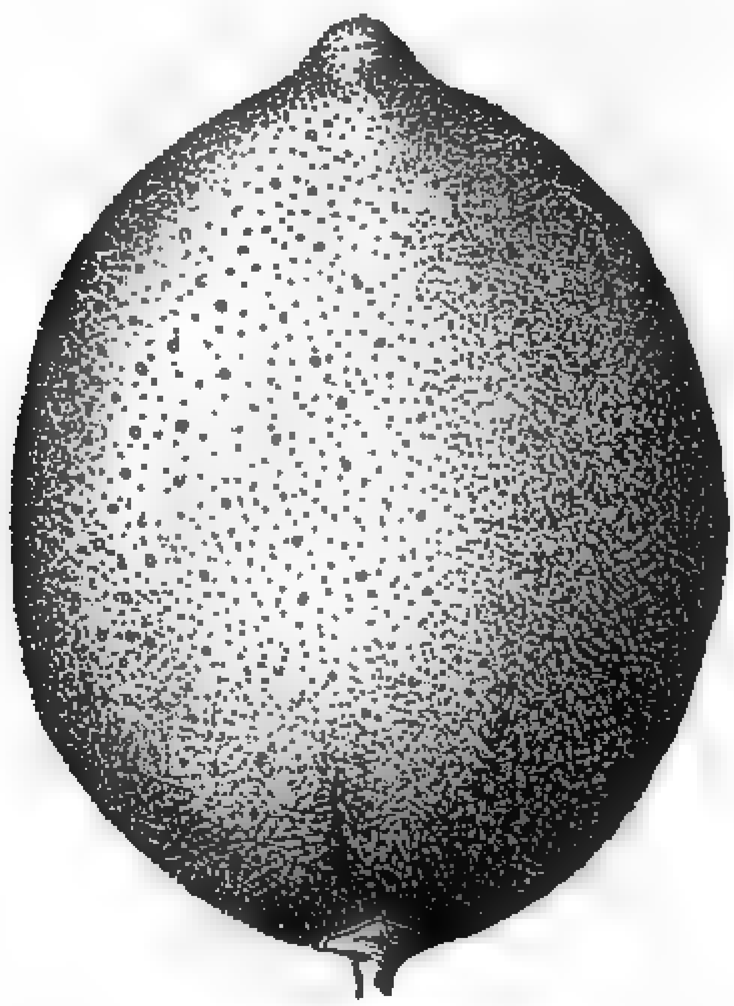


Fig. 350.

rind is closely adherent so that it must be peeled off with a knife; the rind is fragrant, bitter. The fruit must be fresh and sound.—**C.** The rind contains a volatile oil and the juice contains from 7 to 9 per cent citric acid.—**U.** The juice, or the acid, is much used as an antiscorbutic; it is also used as a refrigerant drink in the form of lemonade. In the form of lemon juice it enjoys the popular reputation of curing and preventing "biliousness."

Limon, onis, f, is the lemon tree, of which *limonia, æ,* f, is the fruit. The word *limon* is, however, used for the fruit occasionally.

The *lime,* the fruit of *Citrus acris,* is smaller than the lemon, with a thinner rind somewhat different in flavor from that of the lemon, pale yellowish-green, and with a very acid juice; this variety of fruit is preferred by many in the making of "mixed drinks," "whiskey sour," etc.

Fructus Aurantii

N. Orange.—**O.** The fresh fruit of *Citrus Aurantium Sinensis; Rutaceæ* (*Aurantiaceæ*).—**H.** Subtropical countries.—**D.** Similar in structure to the lemon, but globular or subglobular, without nipple-shaped apex, but with apex sometimes nodulated as in

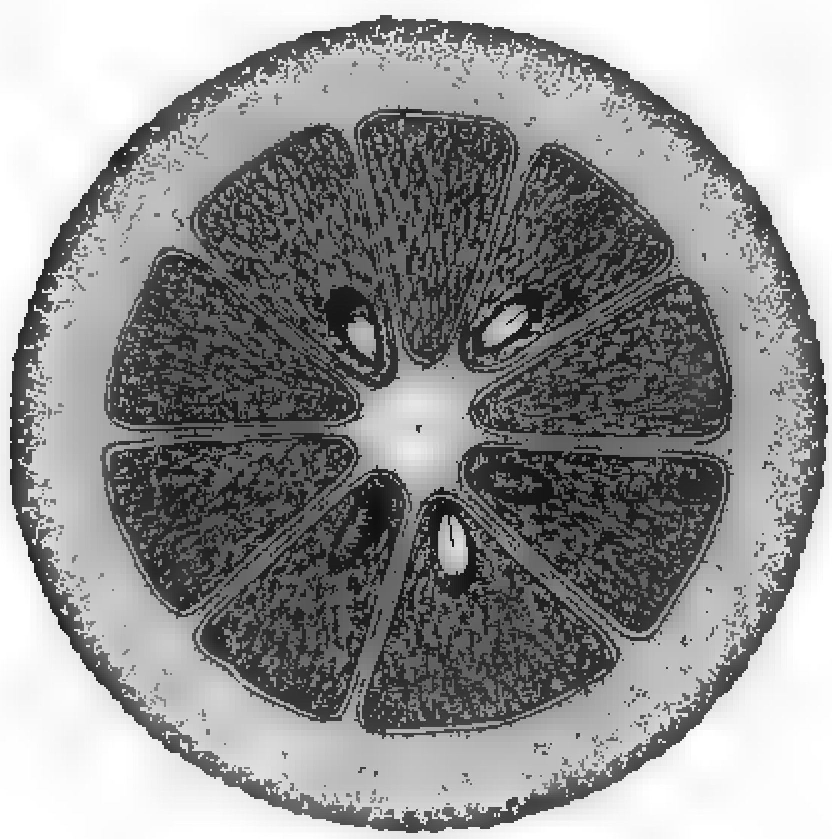


Fig. 351.

the "navel" oranges; glandulous orange-colored rind. Fig. 351 shows a section of an orange; the rind of the orange separates readily from the edible portion within, which is in sections also easily separable from each other; the number of these sections is somewhat variable, as is also the number of seeds which vary in number from many, to none at all as in the "seedless" orange.—**C.** Citric acid, sugar, etc. The rind yields a volatile oil.—**U.** The orange is an agreeably acidulous sweet fruit, and is much used as a refrigerant and refreshing diet; or the juice is expressed and is taken as a refrigerant and laxative drink in febrile conditions.

Diospyros

N. Persimmon.—**O.** The fresh and unripe fruit of ***Diospyros Virginiana; Ebenaceæ.***—**H.** In the rich bottom lands of the rivers of the United States.—**D.** Form and size are shown in Fig. 352, green, smooth, with persistent 4-lobed calyx and about five smooth and dark-brown seeds; odor pleasant fruit-like, taste intensely astringent. On ripening, the quantity of tannic acid decreases, and after frosts in autumn the astringent taste disappears altogether and the fruit becomes a pleasantly acidulous sweet article of diet.—**C.** The unripe fruit contains tannic acid.—**U.** Astringent. Dose: 1 to 5 grams.

Malum, or apple, was described in the previous group, and the description of **Rubus Idæus,** or raspberry will be found in the next group.

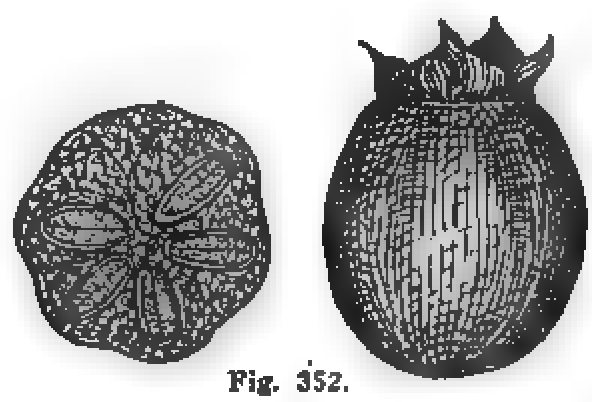


Fig. 352.

Juniperus, or Juniper Berries, are not really berries nor are they fresh, but they have been prepared in a manner similar to that of drying grapes to make raisins, preserved in their own sugar by partially drying. Yet they look like fresh berries and some might look here for them and they are therefore mentioned, but the description is given in the proper place, under Group LXI.

GROUP LX

Fresh Stone Fruits

The only drug of this group is a collective or compound drupaceous fruit.

Numerous red or black stone-fruits united into a small, round-conical cluster with hollow base; sweet, acidulous.......**Rubus Idæus.**

Rubus Idæus

N. Raspberry.—**O.** The fruit of *Rubus Idæus; Rosaceæ.*—**H.** Cultivated in Europe and America.—**D.** Fig. 353 shows the fruit in natural size, whole and in longitudinal section; it consists of about thirty to forty diminutive drupes; each one with a withered style, as shown plainer in the two smaller drawings, which show the individual fruit enlarged, whole and in section. When plucked these small fruits remain attached to each other, but separate from the white, pithy receptacle which remains on the stem; the cluster then forms a round-conical or hemispherical cup-shaped, red, finely hairy "berry," of an agreeable odor and pleasant sweet acidulous taste.—**C.** Citric and malic acids, pectin, fruit sugar, coloring matter, etc.—**U.** For flavoring.

The light-red fruit of *Rubus strigosus* (Wild Raspberry) and

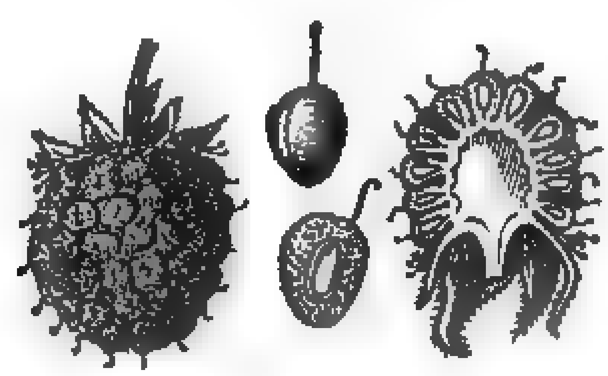


Fig. 353.

the purplish-black fruit of *R. occidentalis* (Black Raspberry) are often used instead of and for the same purposes as the above; a mixture of the red and black raspberries in about equal quantities makes an exceptionally rich-looking and well-flavored syrup.

GROUP LXI

Dried or Prepared Spurious Fruits

Of this group three drugs are dried, hops, long pepper and chenopodium, and two are only partly dried, being prepared or preserved by their own inspissated juices, fig and juniper berries. The structure of each, and therefore the reasons why each must be considered a spurious fruit, being peculiar, this will be explained in connection with the individual drugs.

Before proceeding to the consideration of these drugs it may be well to recall to memory the structure of two kinds of spurious fruits, of the *cone* or *strobile,* and of the *syconium.* The cone is the peculiar compound fruit of the Coniferæ, a class of plants to which the pines, cypresses, etc., belong; the female inflorescence is composed of an axis on which are arranged a number of scales, which are considered to be open ovaries by some, and on the inner side of each scale there may be found one or two naked or uncovered ovules; when this matures, it forms a scaly spurious fruit with one or two naked seeds on the inner side of each scale. The word *strobile* is used by some as synonymous with *cone,* by others is applied to cones which do not become woody, but remain flexible or soft.

The *syconium* is a fleshy receptacle or summit of the plant axis, hollowed out and lined within by a multitude of minute flowers which, when mature, are often supposed to be the seeds, whereas they are the real fruits, and the fleshy receptacle which is used, as in the fig or in rose hips (already considered) is not a fruit, but a spurious fruit.

Strobile with flexible scales; yellowish-green................ **Humulus.**
Small round fruit resembling a berry, about 5 mm. in diameter, brownish-black with bluish bloom................ **Juniperus.**
Compressed, of irregular shape, fleshy, yellowish-brown; very sweet .... **Ficus.**
Cylindrical, about 4 to 5 cm. long, 5 mm. thick, spirally nodulated, stalked, grayish-brown..................... **Piper longum.**
Dull greenish or greenish-brown fruit, about 1 mm. in diameter, depressed globular, obscurely lobed, containing a glossy black seed; peculiar odor and pungent taste...... **Chenopodium.**

Humulus

N. Hops.—**O.** The strobiles of *Humulus Lupulus; Urticaceæ.*—**H.** Cultivated.—**D.** The illustration gives a correct idea of the shape and size of the drug. It is not correct, strictly speaking, to call this a strobile, because the ovules on the inner side of the bracts or scales of the catkin are not naked, but are contained in ovaries, which are in turn contained in a sheathing calyx; the akenes are therefore real fruits (ripened ovary with its contents), but as the bulk of the structure is made up of scales, part of which are the

developed bracts and others the developed calyces, it looks like a strobile and it may be considered to be "a sort of membranaceous strobile" (see Fig. 354). These strobiles or fruit-cones are about 3 cm. long, oval, yellowish-green, and consist of many ovate, membranous, glandulous scales attached to a thin and hairy undulated axis. The fruit is an akene, and it, as well as its enveloping calyx scale, should be thickly beset with minute brownish-red glands. The odor of hops is strongly aromatic and the taste is bitter, aromatic and slightly astringent.—**C.** About 1 per cent volatile oil, 9 to 18 per cent resin, 3 to 4 per cent tannin, etc. The bitter and aromatic properties of this drug reside in the minute glands already referred to, which, when separately sold, constitute the drug which is commonly called "Lupulin."—**U.** Bitter tonic, sto-

Fig. 354.

machic and anodyne. Dose: 1 to 5 grams, in fluid extract or in infusion. Also used locally to allay pain, in the form of dry and hot "hop pillows," or moist as fomentations or poultices.

Hops should be whole and unbroken; the lupulin has probably been at least partially removed from broken or much crumbled drug. Brown, spotted or discolored hops, or hops which is seen under a lens to be poor in lupulin glands, should be rejected for medicinal purposes. Old hops sometimes has a disagreeable odor, from valeric acid formed by the oxidation of the volatile oil; the odor should be fresh, and strongly and pleasantly aromatic.

Juniperus

N. Juniper Berries.—**O.** The ripe fruit, a fleshy cone, of *Juniperus communis; Coniferæ.*—**H.** Northern hemisphere.—**D.** The

fertile catkin of common juniper consists of three fleshy coalescent scales, each with one naked ovule, which, when ripened at the end of the second year, form a fleshy cone or strobile resembling a berry. This fruit is therefore botanically a cone, a form of spurious fruit. Fig. 355 shows a little twig with two fruits in natural size, a fruit enlarged, whole and in section, and seed in natural size and enlarged, and in transverse section enlarged to show the oil-vesicles on seeds. Juniper berries are globular or subglobular, about 5 mm. in diameter, marked on top with three raphes meeting in the center, each triangular space between these being marked with a small wart; externally covered with a bluish bloom, so that they look dark-blue, but where the bloom is rubbed off the color is brownish-black and glossy; internally pithy-fleshy, brownish-green, containing three subtriangular seeds, the seeds having oil-vesicles on their surfaces.

Fig. 355.

Odor peculiar, aromatic and terebinthinate, and taste sweetish spicy.—**C.** From 1 to 2 per cent volatile oil, about 30 per cent sugar, some resin, etc.; they are partially dried, by which they are preserved by their own sugar in similar manner as raisins and figs are preserved.—**U.** Stimulant, diuretic and emmenagogue. Dose: 1 to 5 grams in fluid extract, or a teaspoonful to tablespoonful of "roob juniperi" or syrup.

Ficus

N. Fig.—**O.** The fruit, a syconium, of *Ficus Carica; Urticaceæ.*—**H.** Cultivated in tropical and subtropical countries.—**D.** As found in the trade, figs are partly dried and then compressed into wooden boxes; they are irregular in shape, mostly somewhat flattened, angular, yellowish-brown, fleshy, covered with an efflorescence of sugar, and contain many minute fruits which

are commonly called "seeds;" odor fragrant, fruit-like, and taste very sweet and slightly mucilaginous. Fig. 356 shows the hollow receptacle, whole and in longitudinal section, natural size; it is pear-shaped, short-stalked, with the opening at apex protected by some scales; in the section the part shaded in small dots is the receptacle and the interior shows the manner in which the many minute female flowers are arranged. The smaller drawings represent a few female flowers and one male flower, both much enlarged. The unripe fruit is green, changing on ripening to purplish-green or purplish-red to yellowish-red, ac-

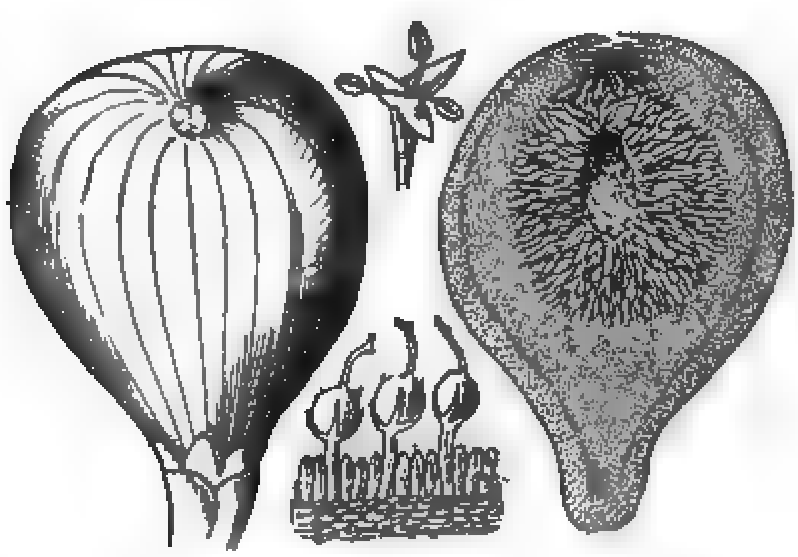


Fig. 356.

cording to variety. The male flowers are situated near the orifice while the interior contains only female flowers; fertilization depends largely on small insects which carry the pollen with them as they enter the receptacle on their way to gather nectar from the flowers within, and it is reported that the figs of California were much improved by the introduction of this insect from the fig-orchards of Smyrna in Asia Minor, from which we obtain the best figs of the trade. While the fruit is green it contains a milky juice, which disappears when the fruit ripens; the matured fruit is up to 8 cm. long and to 5 cm. thick at the widest part, and the compressed commercial fruit resumes its natural shape and size on soaking in water.—**C.** About 62 per cent of sugar, some gum, etc.—**U.** Demulcent and laxative. Roasted figs are sometimes applied to abscesses of the gums as poultice.

Piper Longum

N. Long Pepper.—**O.** The fully grown but still immature fruits coalesced with all the other structures of the spike or inflorescence of *Chavica officinarum; Piperaceæ.*—**H.** East Indian and Philippine Islands.—**D.** The rhachis, bracts and ovaries all develop and enlarge on fertilization and become consolidated into a cylindrical mass which is about 3.5 to 5 cm. long and about 5 mm. thick, with a stalk about 1 cm. long and with the fruits arranged spirally around the rhachis, giving the whole a

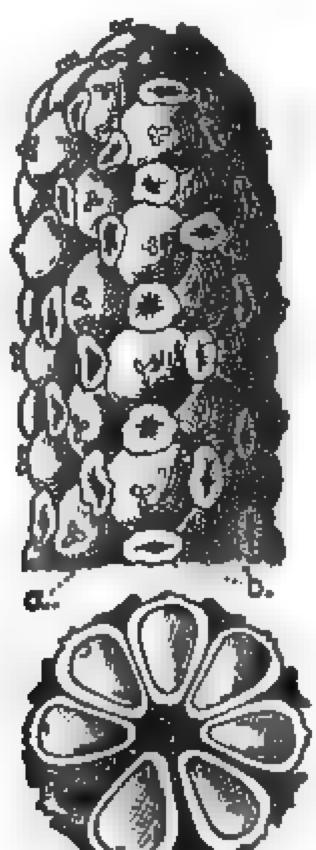


Fig. 357.

nodulated appearance; blackish-gray, dusty; odor and taste like those of black pepper. One of the drawings of Fig. 357 shows the tip (about one-fourth of total length) of the fresh female spike, *a* being the berries and *b* the bracts which accompany the ovaries and which develop as the fruit develops. The other drawing shows a section of the cylinder, with about 7 to 8 berries arranged around the rhachis of the spike. Both drawings are very much enlarged. All of these structures are present in the drug, but when dried and partially disfigured by attrition (to which the dusty appearance of the drug is due) cannot be seen

as distinctly in the drug as in the fresh spike or in the drawing.—**C.** Like those of black pepper; piperin, fatty oil, resin, volatile oil, etc.—**U.** Condiment, mainly; stimulant carminative. Dose: 0.3 to 1.5 grams.

Chenopodium

N. Chenopodium, Wormseed, American Wormseed.—**O.** The fruit of *Chenopodium ambrosioides,* var. *anthelminticum; Chenopodiaceæ.*—**H.** Sub-tropical America, but naturalized and a common weed in United States.—**D.** Small, depressed-globular, slightly lobed or ridged fruits, about 1 mm. in diameter, yellowish-gray to greenish-brown, very brittle and fragile; the minute seed is flattish, circular, glossy black, with the embryo curved around the edges of the seed; the fruit is a utricle, but it is so closely surrounded by and united with the five segments of the calyx which form the bulk of the fruit, that it is more proper

Fig. 358.

to consider this to be a spurious fruit. Fig. 358 shows a section of a seed, and the whole fruit, both much enlarged; the lobing is, however, often much less prominently marked. Odor offensively aromatic, peculiar and taste bitterish pungent.—**C.** Volatile oil.—**U.** Anthelmintic. Dose: 1 to 2 grams.

GROUP LXII

Dry Fruits

There is a great diversity of forms of fruits of this kind and works on botany give separate and distinctive names to quite a number of varieties of these fruits. The main characteristic of fruits of this group is, that the ovary develops into a dry, membranous, or even stony or hard structure in which the seed or seeds are contained; rarely does any part of such fruits remain fleshy, when fully ripe.

It will facilitate the study of this group of drugs to review briefly the characteristics of important forms, although the different authors on pharmacognosy lay no particular stress on the correct botanical definitions of the names of fruits which they employ, so that what one author calls a carpel another may call a follicle, and still another may call it a capsule.

A broad distinction may be based on the dehiscence. Some dry fruits dehisce or open when ripe; these usually contain several or many seeds and some authors call all such dehiscing dry fruits "pods" or "capsules." Other dry fruits are indehiscent, that is, they do not open, but the ovary forms an envelope for the seed which remains closed, and which is often so seed-like in appearance that such fruits may be mistaken for naked seeds. In fact, in the ordinary trade nomenclature fruits of this kind are usually spoken of as "seeds," as for instance "hemp seed," "anise seed," etc. Indehiscent dry fruits are usually one-seeded.

The word "carpel" is used by many authors to designate certain dry fruits; the word, however, does not properly designate a fruit, for it means a simple pistil; each component leaf or pistil of a compound pistil is also a carpel; a flower may contain one or several or many separate or simple carpels. When a simple carpel matures into a fruit, or when each component carpel of what in the flower appeared to be a compound pistil matures into a separate fruit, such fruits may be akenes, follicles, legumes, pods, utricles, etc., but it is customary also to refer to such fruits as "carpels," especially when it is a little difficult to determine just what else to call them.

For convenience we will group dry fruits as dehiscent and indehiscent, and we will call the dehiscent fruits "pods" or "capsules" and will divide the indehiscent fruits into "akenes" and "cremocarps." These names and a few other names of fruits we will now briefly define.

The *pod* is any dry dehiscent fruit; it may be the product of a simple pistil, and it is then called a *follicle* if the carpel opens or dehisces on one side only, as in the fruit of star anise, or a *legume* or *true pod* when it opens on both sides, as in the pea or bean; or it may be the product of a compound pistil, when it is properly called a *capsule*, as in poppy.

Some few fruits have the structure of dehiscing fruits or pods,

yet do not dehisce at maturity, as, for instance, the pods of purging cassia and of St. John's bread; yet they must be placed among the pods, or dehiscing fruits, because they belong there on account of their structure. It must be borne in mind, however, that some such fruits, if left ungathered, would probably dry out and decay so that dehiscence would take place at the beginning of the following season; in other words, there are many pods that remain unopened through the winter, but open and drop their seeds early next spring when it is the proper time to sow them. Such may possibly be the case also with these two "indehiscent pods."

The *akene* is a small, indehiscent, one-seeded fruit; the fruits of composite flowers are also called akenes; the *utricle* is an akene

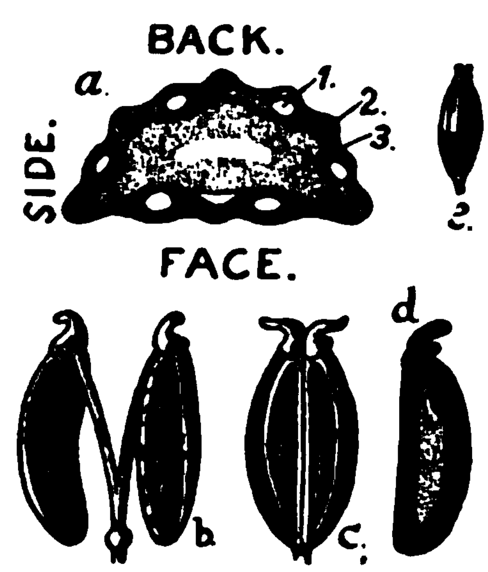


Fig. 359.

in which the ovary forms a thin, bladdery sac surrounding the seed, which may either break open irregularly or can be broken and removed by rubbing; the *caryopsis* or *grain* is an akene in which the ovary forms a thin membranaceous coating which is intimately united with the seed, appearing therefore to be merely a seed-coat, as in wheat, corn, etc.; in a *nut* the ovary is changed to a hard, stony shell (made up of stone-cells) as in the hazel nut; *cremocarp* is the name given to the fruit of the *Umbelliferæ* or umbelliferous plants, in which two carpels are intimately attached in the blossom, both developing into akenes which sometimes separate when ripe, as in fennel and caraway, and sometimes remain permanently attached to each other as in anise and coriander.

We will consider the *cremocarps* (also called *schizocarps* by some authors) a little more fully. In Fig. 359 *e* shows the mature fruit

of fennel, the two carpels or akenes still attached to each other, and *c* shows the same enlarged; in *b* the fruits are seen separated but held together by the two-pronged prolongation of the receptacle, which is very brittle and easily broken so that the fruits are then entirely separated; *d* is a longitudinal section, showing the embryo imbedded in the upper part of the albumen of the seed; *a* is a transverse section of the fruit, showing the wall formed by the ovary and the albumen of the seed within (3), while 1 points out an oil-duct, or oil-tube (Latin: *vitta*, pl., *vittæ*) which runs the length of the fruit, and 2 indicates a fibro-vascular bundle; the fibro-vascular bundles are at the angles, and projecting outwardly where they are situated there are more or less distinctly marked ridges, giving characteristic appearances to the cross-sections and enabling us to recognize the various fruits of this kind thereby; between the fibro-vascular bundles are oil-ducts, varying in number in different kinds of cremocarps, but fairly uniform in number in cremocarps of the same kind. With this explanation the enlarged drawings of the various cremocarps become self-explanatory. To examine these fruits, soak in water and cut transversely about the middle of the fruit; then examine the cut ends with a lens; or a thin section may be cut from one of these pieces and cleared with solution of hydroxide of potassium, and then examined under the microscope.

The taste and odor of most of the cremocarps are very characteristic.

Capsules or Pods

Small, obtusely triangular, 3-celled capsules, 10 to 15 mm. long; central placenta with many brown seeds; pale buff .... **Cardamomum.**

Eight reddish-brown woody follicles, arranged star-shaped; often some of the carpels are aborted; odor anise-like .... **Illicium.**

Large, round or elongated, pale brownish-yellow capsules, 1-celled, with many parietal placentas and containing many white or bluish seeds .... **Papaver.**

Fleshy, linear, dark-brown pod, up to 25 cm. long by 8 mm. thick; very fragrant .... **Vanilla.**

Hard, rigid, cylindrical, dark-brown pod, up to 60 cm. long by 2.5 cm. thick .... **Cassia Fistula.**

Flat, broad, glossy brownish pod, about 10 to 20 cm. long, with up to 12 seeds; with sweetish pulp...... **Ceratonia.**

From 2 to 5 small, somewhat thick and fleshy pods attached to a short stalk; each about 5 mm. long and containing 1 or 2 glossy black seeds.............. **Xanthoxyli Fructus.**

AKENES

Obovate-oblong, brownish-gray, somewhat curved akene, about 6 mm. long................................ **Lappæ Fructus.**

Sub-globular, brownish or greenish-gray akene, about 4 mm. in diameter, with a single oily seed........... **Cannabis Fructus.**

Elliptic grain, about 7 to 9 mm. long, enclosed in straw-colored paleæ; taste farinaceous.................. **Hordei Fructus.**

Like preceding in appearance, but with sweet taste.... **Maltum.**

Very small subglobular utricle, about 1 mm. in diameter; dull greenish-brownish color; contains shining black seed .... **Chenopodium.**

Elliptic, flattened, glossy pale, yellowish grain, about 4 mm. long .... **Phalaridis Fructus.**

CREMOCARPS

Usually remaining united; with oil-tubes

Oval; each fruit with 5 obscure ridges and about 16 oil-tubes; grayish, finely hairy...................... **Anisum.**

Globular, hollow, some of the ridges wavy; each fruit with 2 oil-tubes on inner face; brownish-yellow, smooth .... **Coriandrum.**

Elongated, compressed from sides; each fruit with 5 ridges and 6 oil-tubes; yellowish-brown; rough hairy .... **Cumini Fructus.**

Elongated, nearly cylindrical, with 5-toothed calyx, ridges not prominent; each fruit with 6 oil-tubes; brownish-green .... **Phellandrii Fructus.**

Often remaining united; without oil-tubes

Oval, compressed from sides; each fruit with 5 nodulated ridges and 2 deep lateral grooves; no oil-tubes; albumen crescent-shaped in transverse section; brownish-green .... **Conium.**

Usually separating; with oil-tubes

Elongated, compressed from sides; each fruit with 5 obscure ridges and 6 oil-tubes; usually curved; brown .... **Carum.**

Elongated, nearly cylindrical; each fruit with 5 angular ridges and 6 oil-tubes; smooth; yellowish-brown.... **Fœniculum.**

Roundish-ovate, compressed from sides; each fruit with 5 obscure ridges and 6 oil-tubes; grayish-green.... **Petroselini Fructus.**

Oval, compressed from back; each fruit with 3 sharp-keeled dorsal ridges and 2 long lateral ridges forming thin broad margins; 6 oil-tubes; brown........ **Anethi Fructus.**

Very small, roundish-ovate, compressed from sides, smooth; each fruit with 5 angular ridges and 12 to 15 oil-tubes; brown .... **Apii Fructus.**

Elliptic, compressed from back; each fruit with 5 prominent ridges, the lateral ones larger, and 6 oil-tubes; yellowish-brown .... **Levistici Fructus**

Elliptic, compressed from back; each fruit with 3 prominent dorsal ridges and 2 long, flat, lateral ridges; numerous oil-tubes; yellow......................... **Dauci Fructus.**

Oval, compressed from back; each fruit with 7 ridges, 2 lateral and 2 dorsal spinous, and 3 dorsal short-hairy; 6 oil-tubes; grayish-brown.................. **Angelicæ Fructus.**

Cardamomum

N. Cardamom.—**O.** The fruit of *Elettaria Cardamomum; Zingiberaceæ.*—**H.** Malabar and India.—**D.** Ovoid or oblong 3-celled capsules, obtusely triangular, rounded at base and beaked at apex, about 1 to 2 cm. long, with central placenta and numerous brown, aromatic seeds and a thin, tough, leathery, buff-colored, tasteless shell.—**C.** The seeds contain about 4 to 5 per cent of an aromatic volatile oil.—**U.** As a spice, carminative and stomachic; mainly as a flavoring agent and corrective. Dose: About 1 gram.

Malabar cardamom and Aleppy cardamom are the only varieties generally employed in the United States. There are several other varieties, and the seeds may be derived partly from some of these; for instance, Madras cardamom, the round cardamom, and the Ceylon cardamom.

All kinds of cardamoms are designated according to size by the terms, *shorts, short-longs* or *medium,* and *longs. Shorts* are from 10 to 15 mm. long; *mediums* from 15 to 25 mm. long, and *longs* from 2.5 to 5 cm. long. Malabar cardamoms are best. They are either *shorts* or *short-longs,* bleached or unbleached; the choicest are short, plump, heavy, and have a pale straw color without any green tint, and they yield from 3/4 to 4/5 of their weight of seeds.

Madras cardamoms are pale and thin, not plump, *short-longs.*

Aleppy cardamoms are *shorts,* of a somewhat greenish tint, and are of inferior quality.

Ceylon cardamoms are *longs,* dark grayish-brown, and differ in odor and taste from the above kinds.

In Fig. 360 *a* and *b* are Malabar *shorts; c,* Malabar *mediums,* and *d* Malabar *longs; e* is a section of Malabar cardamom, slightly enlarged; *f* is round cardamom, from Java, and *g* is a section of the same, slightly enlarged; *h* shows Ceylon *longs;* except as otherwise noted, all are natural size. Cardamom seeds come into the trade as such, and are therefore described in their proper place, under Group LXVI.

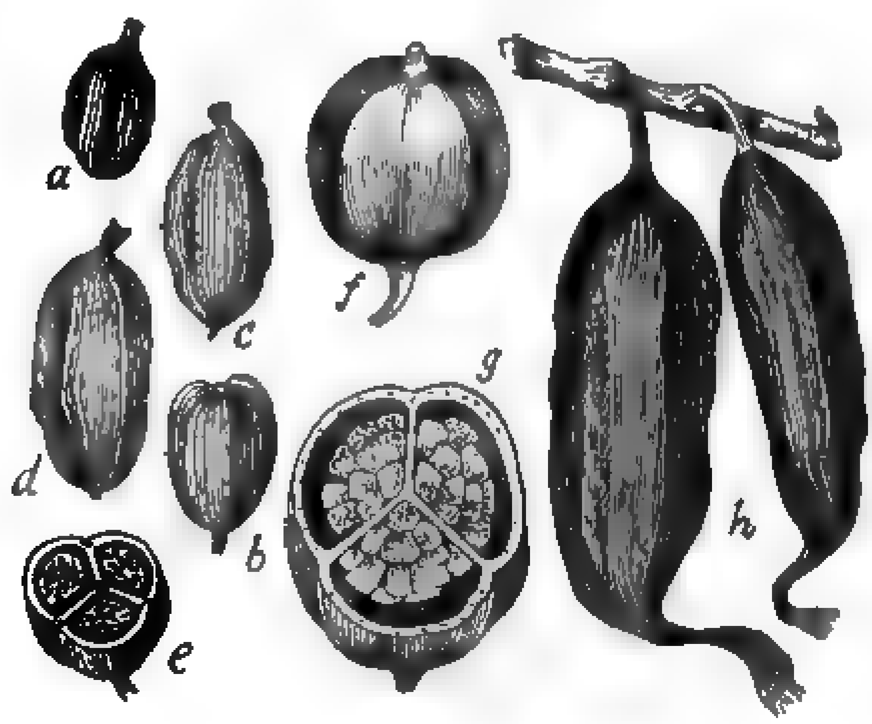


Fig. 360.

Illicium

N. *Fructus Anisi Stellati,* Star Anise.—**O.** The fruit of *Illicium verum; Magnoliaceæ.*—**H.** China, Siam, Anam. **D.** A multiple fruit consisting of eight reddish-brown, woody follicles, arranged in a star-shaped or radiate whorl around a short central receptacle or axis which is a continuation of the stalk; often the follicles are unevenly developed, or some are aborted, and generally the drug is much broken; each follicle is from 10 to 15 mm. long, boat-shaped, somewhat wrinkled, with straight point or beak, open at the upper suture, exposing the flat oval, glossy brown seed; odor like that of anise, taste sweetish aromatic. In Fig.

361-*A* are shown two large, well-developed fruits, one from the upper and the other from the lower side, two imperfectly and irregularly developed fruits, one follicle and one seed.—**C.** The follicles yield upwards of 5 per cent and the seeds about 2 per cent of a volatile oil that is practically identical with that of anise; the total yield of the fruit is about 4 to 4½ per cent of this oil; there is also a fixed oil, etc.—**U.** Similar to those of anise; stimulant, carminative and stomachic, but mainly as a flavor; it is also an ingredient of many of the "pectoral teas." Dose: 0.5 to 2 grams.

Adulteration.—The fruits of *Illicium religiosum,* shown in Fig.

Fig. 361-A.

361, are sometimes found mixed with the fruit of star anise, and in such case they were probably added as an adulteration. The follicles of this fruit are rougher, more wrinkled and shriveled, and have a beak or point that is bent upwards. The odor is faintly aromatic, possibly from having been in contact with the star anise, somewhat clove-like, and the taste is disagreeable, somewhat saline, faintly reminding of cardamom. The fruits are smaller than those of star anise and in bulk have the appearance of being lighter in color, the follicles being more opened, so that the lighter-colored interior is more exposed. This fruit is also called *shikimi fruit,* and it is said to be poisonous; but if so, it cannot

be very poisonous because no serious effects seem to have followed its admixture to star anise; the author once found a lot in trade which consisted of at least one-third of its weight of *shikimi*, and he chewed freely of this spurious star anise, without any effects whatever, and the lot was disposed of most likely in small lots by the wholesaler from whom a small quantity was obtained by the writer, and no bad effects were noted by anyone.

Fig. 361-*B*.

Papaver

N. Poppy, Poppy Heads.—**O.** The fruit of *Papaver somniferum; Papaveraceæ;* gathered before they are quite ripe.—**H.** Asia Minor and India; cultivated.—**D.** There are capsules of various shapes, from elongated, to round and compressed or flat, but Fig. 362 gives a good idea of the average size and shape; the capsule is pale-brown or buff-colored externally, with a large persistent stigma, under the lobes of which are small valves which open at the time of dehiscence and allow the seeds to fall out. The walls of the capsule are brittle, and many of the capsules are broken in the drug; one-celled, but with many (8-15) parietal placentas to which numerous seeds are attached; most seeds are removed from the drug, but enough are always present to determine the kind; there are two varieties of poppy, the so-called "black" which has bluish seeds and the "white" which has white seeds.

It is usually stated that the white is to be preferred, but more probably there is no difference between the two kinds. The drug has no odor, but a somewhat bitter taste.—**C.** As these capsules, when fresh, furnish an exudation which forms opium, and as this milky juice is retained in the unincised capsules that are gathered for this drug, its constituents are the same as those of opium

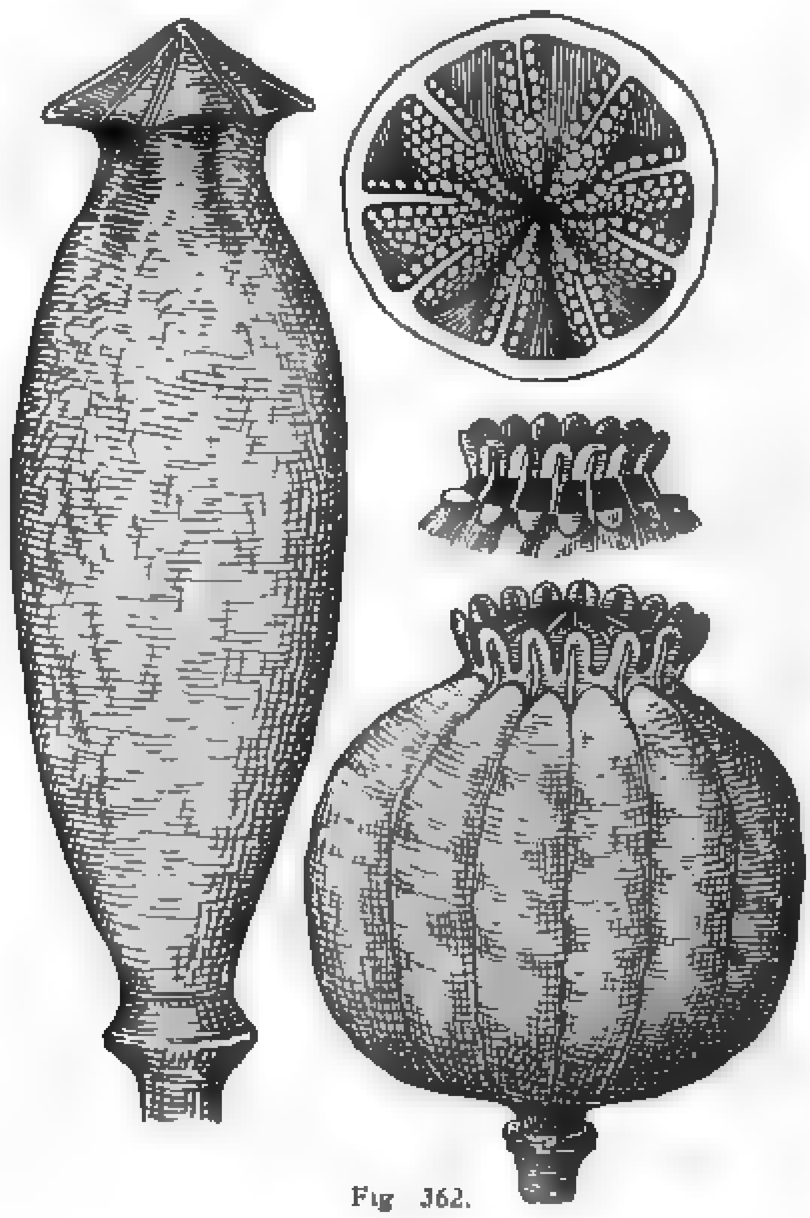


Fig. 362.

(which see) but in very variable and uncertain proportions.—**U.** Slightly anodyne and sedative; mainly used in decoction or syrup as a cough medicine. Dose: 0.5 to 2 grams.

Vanilla

N. Vanilla.—**O.** The fruit, a fleshy pod, of *Vanilla planifolia; Orchidaceæ;* gathered before it is quite ripe.—**H.** Mexico; culti-

vated in other tropical countries.—**D.** The fruit of Vanilla is a dark-brown, flexible pod, from 15 to 25 cm. in length, and from 4 to 8 mm. in thickness, linear, obtusely triangular, hooked at the base and obliquely narrowed at the apex; the walls of the pod are soft-leathery, and the interior is filled with a blackish-brown, oily pulp in which numerous minute black seeds are imbedded; odor and taste peculiarly aromatic and fragrant. Fig. 363 shows a whole pod, cut in halves to allow of illustration in natural size, and also a section enlarged, which may be prepared by first cutting it, then extracting the oil, etc., with ether, then soaking in dilute alcohol, then in water, to remove the color,

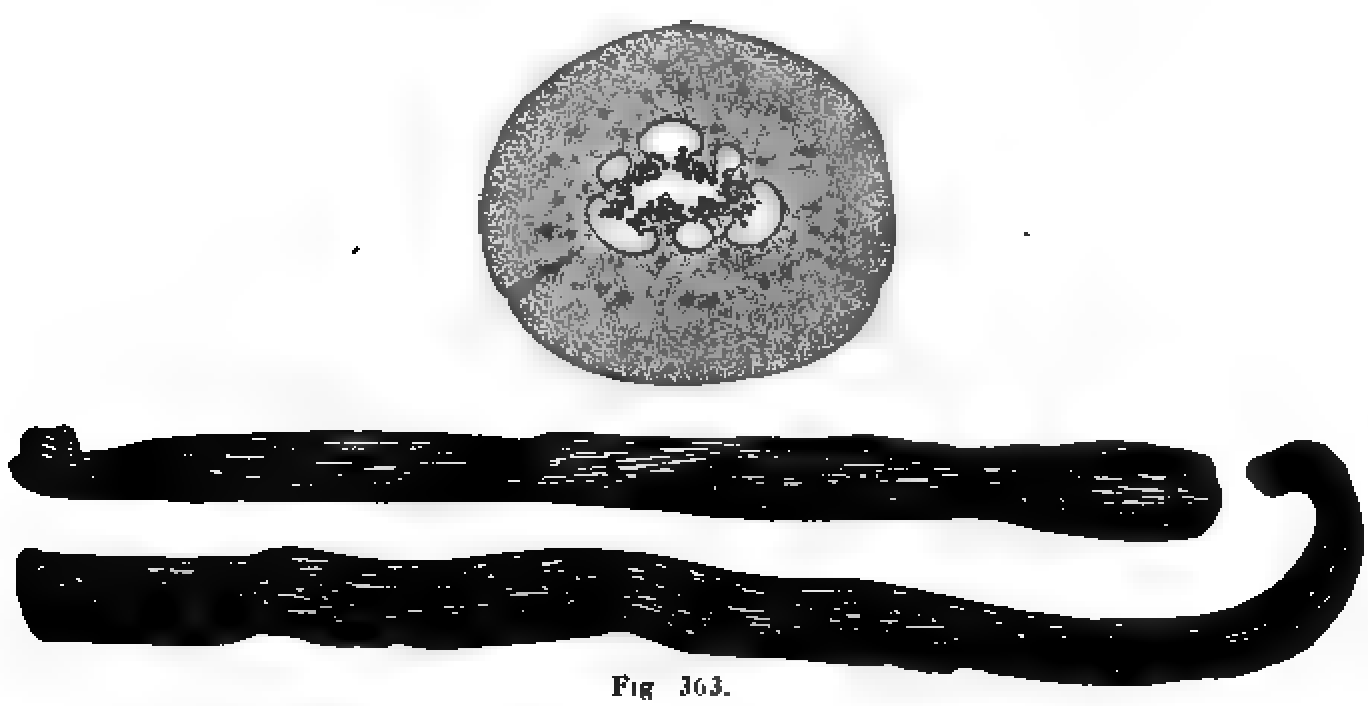


Fig 363.

and finally clearing, as usual. The pod is one-celled, but has several placentas which bear the numerous seeds.—**C.** About 2 per cent of vanillin, some of which sometimes forms a crystalline efflorescence on the outer surface of the drug; some fixed oil, sugar, etc.—**U.** For flavoring.

When ripe, the pod opens along the two darker-colored lines seen in the section; but it is gathered while still unripe and is treated by a process of "sweating" or fermentation, by which its aroma is fully developed and dehiscence is prevented.

Mexican vanilla is the best kind; it sometimes is more than 25 cm. long. It comes into trade tied into bundles containing about 50 fruits each; these bundles are then wrapped in tin-foil and several bundles are packed in a tin box.

Bourbon vanilla is shorter, lighter-colored, and its odor resembles somewhat that of tonka bean. Venezuelan, Brazilian and other varieties of vanilla are not usually found in the trade.

Vanilla is valued to a great extent by length; it is assorted according to length, and the longer the bean the higher the price of any given weight of the drug.

Cassia Fistula

N. Purging Cassia.—**O.** The pod of *Cassia Fistula; Leguminosæ.*—**H.** West Indies.—**D.** An indehiscent, hard, rigid, cylindrical pod with two raphes on opposite sides down the length of the fruit; up to 60 cm. long and 2 to 3 cm. in diameter, of a rich dark-brown color, and containing in separate transverse cells from 25 to 100 ovate, flattish, glossy reddish-brown

Fig. 364.

seeds imbedded in a thick, tough, blackish-brown, sweet pulp which has the odor of prunes. Fig. 364 shows a small end of one of the fruits in natural size.—**C.** Good purging cassia contains about one-third of its weight of pulp, which is the only valuable portion; this pulp contains about 60 per cent of sugar, some mucilage, pectin, etc.—**U.** Mild laxative, mainly employed in combination, as in confection of senna. Dose: As a laxative, 5 to 10 grams; as a purgative, 25 to 50 grams.

Ceratonia

N. *Siliqua Dulcis;* St. John's Bread.—**O.** The pod of *Ceratonia Siliqua; Leguminosæ.*—**H.** Southern Europe and the Orient.—**D.** An indehiscent, flat, broad, glossy brownish pod, about 10 to 20 cm. long, 2 to 3 cm. broad and 3 to 8 mm. thick, thicker at the edges than in the center, grooved at the edges; the external fruit-coat is

leathery; the interior contains from 3 up to 12 or 13 transverse cells, each lined with a papery membrane and containing a flattish oval, glossy brown and very hard seed in a pulp, which in the dry condition, as in the drug, is tough and alveolar, and which has an agreeably pleasant odor and taste. Fig. 365 shows one pod whole, one partly split in half and a tranverse section of a pod.—**C.** 40 to 50 per cent of sugar, some mucilage, pectin,

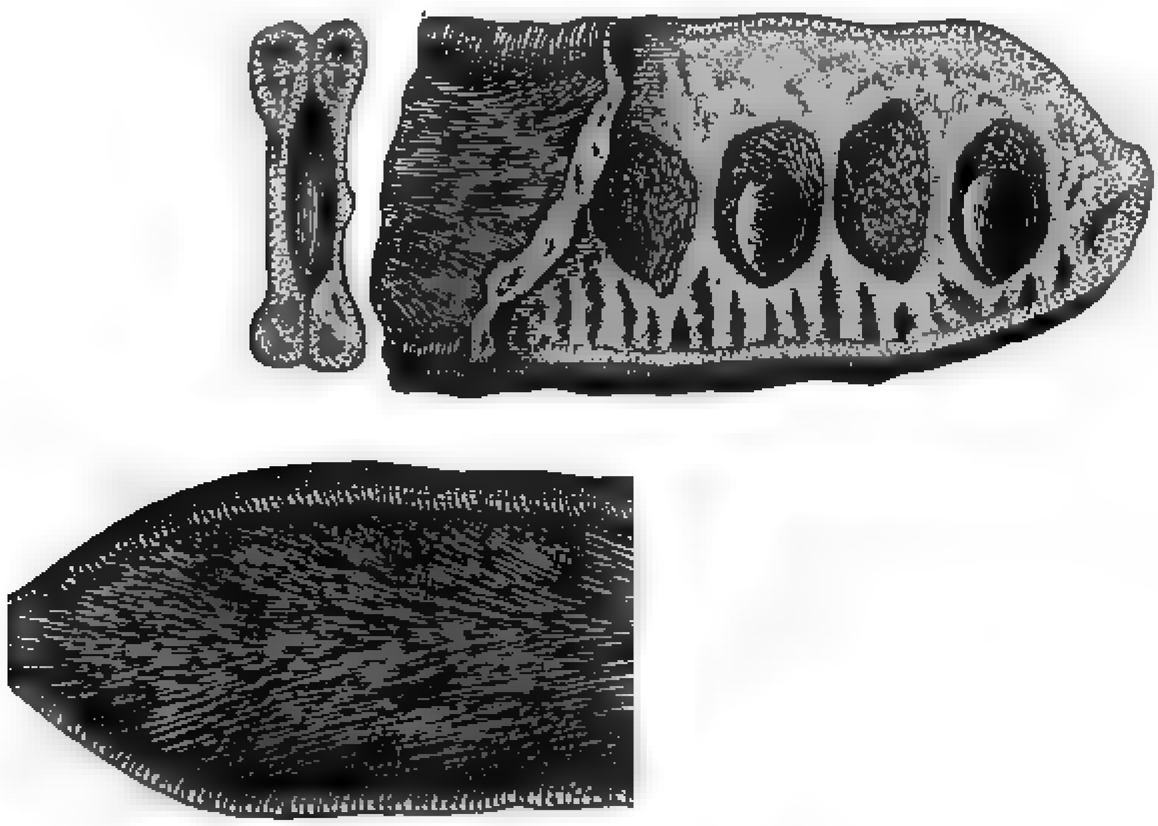


Fig. 365.

etc.—**U.** Slightly laxative and demulcent; occasionally used in pectoral teas, etc.; sometimes imported as food for cattle, but in the drug-stores used mainly as "laggniappe."

Xanthoxyli Fructus

N. Prickly Ash Fruit, Prickly Ash Berries.—**O.** The fruits of *Xanthoxylum Americanum (X. fraxineum)* and *X. Clava-Herculis (X. Carolinianum)*; *Xanthoxylaceæ*.—**H.** United States.—**D.** Somewhat thick and fleshy pods, some with, most without stalks, each about 4 to 5 mm. long, yellowish-brown, somewhat wrinkled and containing 1, more rarely 2, glossy, black seeds. The pods of *X. car.* grow in clusters of 2 or 3, those of *X. fr.* in clusters of 3 to 5, but they rarely remain attached to each other

in the drug, but are usually broken apart and partly opened from the separation of the two valves, and often empty and mixed with the separated seeds. The seeds are subglobular when single, compressed and flattened when two in a pod, wrinkled, glossy black, and contain a white albumen and embryo. Fig. 366 shows three

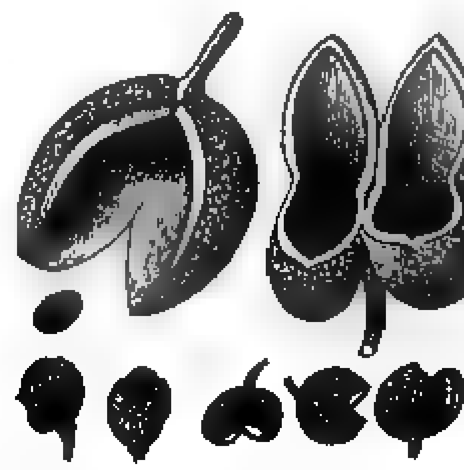


Fig. 366.

pods much enlarged, and several pods and a seed in natural size. Odor aromatic, taste pungent.—**C.** Volatile oil, resin, etc.—**U.** Nervine tonic, arterial stimulant, sialagogue, diaphoretic and alterative. Dose: 0.5 to 2 grams.

Lappæ Fructus

N. Burdock Fruit, Burdock Seed.—**O.** The fruit (akene) of *Lappa officinalis; Compositæ.*—Europe and America.—**D.** The akenes, shown in Fig. 367 in natural size and enlarged, are obovate-oblong, flattened, transversely wrinkled, sometimes somewhat curved, about 6 mm. long, to 3 mm. wide, brownish-gray,

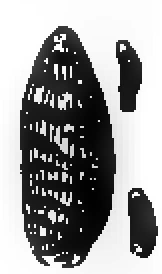


Fig. 367.

mottled; pappus stiff hairy-bristly, but usually wanting in the drug. No odor, taste bitter.—**C.** Fixed oil, resin, some bitter principle, etc.—**U.** Bitter tonic; alterative in psoriasis, etc. Dose: 1 to 4 grams, best in fluid extract.

Cannabis Fructus

N. Hemp Seed.—**O.** The fruit (akene) of ***Cannabis sativa; Urticaceæ (Cannabinaceæ)***.—**H.** Indigenous to Asia, but cultivated everywhere; see also Group IX.—**D.** Fig. 368 shows the fruit natural size, and whole and in longitudinal and transverse sections, all much enlarged. An oval or subglobular akene, about 4 mm. long by 2 mm. broad; the fruit-shell is greenish or grayish-brown externally, with a whitish keel on the margin, netted-veined, smooth, internally dark olive-green or brown, brittle, one-

Fig. 368.

celled, two-valved, but not dehiscent, and contains one white, oily seed consisting of a curved embryo without albumen; no odor, taste nutty, sweet.—**C.** About 30 per cent fixed oil, albuminoids, sugar, etc.—**U.** Sometimes used as a demulcent in the form of an emulsion, but most frequently used for bird-food.

Hordei Fructus

N. Barley.—**O.** The fruit (caryopsis or grain) of *Hordeum distichum; Graminaceæ*.—**H.** Cultivated.—**D.** Fig. 369 shows barley

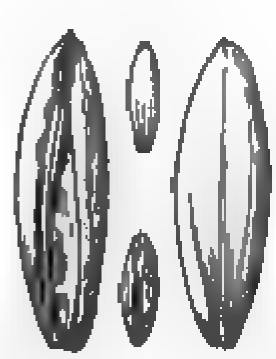


Fig. 369.

in natural size and enlarged, with the paleæ enclosing the fruit proper and closely united therewith. The fruit is from 7 to 9 mm. long, 2 to 3 mm. broad, tapering towards the ends, with a groove along the front, smooth on the back, straw-colored on account

of the adhering paleæ, brownish when the latter are removed; no odor, taste mealy.—**C.** About 60 to 70 per cent starch, gluten, sugar, fat, etc.—**U.** Food.

Maltum

Maltum Hordei, or malt, is made by causing barley to germinate until the sprout reaches about the length of the fruit, when further germination is stopped by quickly raising the temperature and drying the fruit; barley loses about 10 to 20 per cent of its weight when changed to malt, and much of the starch is changed to dextrin, sugar, etc.

For Pearl Barley see Group LXX.

Chenopodium, or American Wormseed, is sometimes considered to be a dry fruit. It is really a utricle, but is enclosed in the calyx, which constitutes the bulk of the fruit, for which reason it has been described in Group LXI, Spurious Fruits.

Phalaridis Fructus

N. *Semen Canariense,* or Canary Seed.—**O.** The fruit (caryopsis or grain) of *Phalaris Canariensis; Graminaceæ.*—**H.** Indigenous to the Canary Islands, but also cultivated elsewhere.—**D.** The drawings show Canary Seed in natural size and enlarged. An

Fig. 370.

elliptic fruit, about 4 mm. long and $1\frac{1}{2}$ mm. broad, flattish, enclosed in two hard paleæ which are not united with the fruit; the paleæ are keeled, glossy yellowish-gray and finely hairy, and the enclosed fruit is smooth, brownish, with a small embryo and a mealy albumen.—**U.** One of the usual ingredients of "mixed bird seeds."

Anisi Fructus

N. *Anisum,* Anise.—**O.** The fruit of *Pimpinella Anisum; Umbelliferæ.*—**H.** Indigenous to the Orient, but also cultivated in Europe.—**D.** Oval, about 2 to 3 mm. long, grayish or grayish-green, finely hairy; the two mericarps usually remain adherent; each fruit has 5 obscure ridges and about 16 (but sometimes up to 30 or more) oil-tubes; odor peculiar, aromatic, taste spicy,

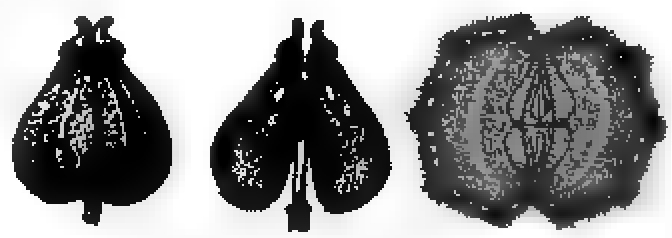


Fig. 371.

sweet.—**C.** About 1.5 to 3 per cent volatile oil, some fixed oil, sugar, etc.—**U.** Carminative, stimulant; mainly used for flavoring. Dose: 0.5 to 1 gram.

Anise should be plump and sound, and free from dirt and small stones, with which it is often mixed. It is said to be sometimes mixed with Conium fruit which it somewhat resembles, but the writer has never seen any such admixture.

Coriandri Fructus

N. *Coriandrum,* Coriander.—**O.** The fruit of *Coriandrum sativum; Umbelliferæ.*—**H.** Asia and Europe; cultivated.—**D.** Globular, about 3 to 4 mm. in diameter, light-brown; the two meri-

Fig. 372.

carps remain adherent, each fruit having 5 wavy and 4 straight ridges on the back; face concave, thus making the whole fruit hollow; each fruit has 2 oil-tubes on the face; the fresh fruit has a nauseous odor, reminding of bed-bugs, but the dried fruit is agreeably aromatic, taste spicy.—**C.** About 0.5 per cent volatile oil, some fixed oil, etc.—**U.** Carminative, stimulant; mainly used for flavoring. Dose: 0.5 to 2 grams.

Cumini Fructus

N. *Cuminum,* Cumin.—**O.** The fruit of *Cuminum Cyminum; Umbelliferæ.*—**H.** Northeastern Africa.—**D.** Oblong or elongated, compressed from the sides, about 4 mm. long, yellowish-brown; the two mericarps remain adherent; each fruit has 3 prominent

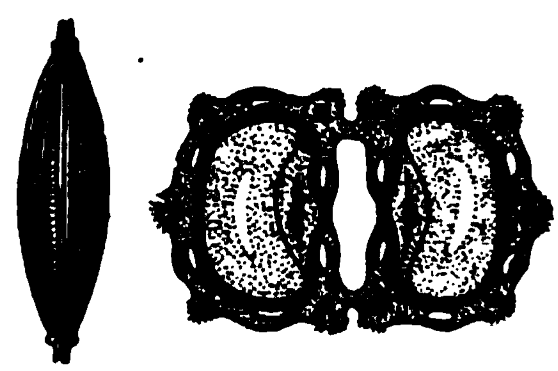


Fig. 373.

ridges which are narrow and beset with fine hairs, and 4 broad grooves down the middle of each of which there is a slight ridge with short, soft spines; each mericarp has 6 oil-tubes, 4 lying under the grooves and 2 on the face; odor and taste peculiar, resembling caraway.—**C.** Volatile oil, the yield of which is variously stated, from 0.25 to 3 per cent (probably because the yield is very variable), some fixed oil, resin, etc.—**U.** Carminative, stimulant. Dose: 0.5 to 2 grams.

Phellandrii Fructus

N. *Phellandrium,* Water-Fennel, 5-leaved Water Hemlock.—**O.** The fruit of *Oenanthe Phellandrium; Umbelliferæ.*—**H.** Europe

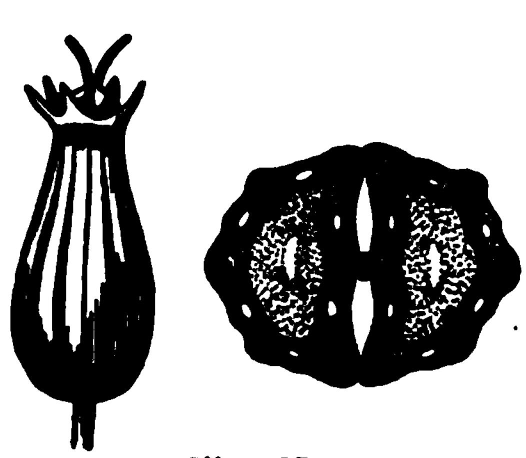


Fig. 374.

and Northern Asia.—**D.** Oblong or elongated, nearly cylindrical, but tapering toward the upper end, about 4 mm. long, smooth, brown or blackish-brown; the two mericarps remain adherent; each fruit has 5 obtuse ridges, 4 narrow grooves and 6 oil-tubes;

taste and odor disagreeably aromatic.—**C.** A volatile alkaloid resembling coniine (?), about 1 per cent volatile oil, some fixed oil, resin, etc.—**U.** Carminative, stimulant, diaphoretic, diuretic, and when fresh probably somewhat narcotic. Dose: About 0.5 gram, or up to 2 grams during 24 hours.

Conii Fructus

N. *Conium,* Hemlock Fruit.—**O.** The full-grown but unripe fruits of *Conium maculatum; Umbelliferæ.*—**H.** Europe and Asia; naturalized in North America.—**D.** Oval, compressed from sides, about 3 mm. long, grayish to brownish-green (brown or brownish-black when ripe); if gathered when ripe or nearly ripe the two mericarps generally separate, but if gathered while still

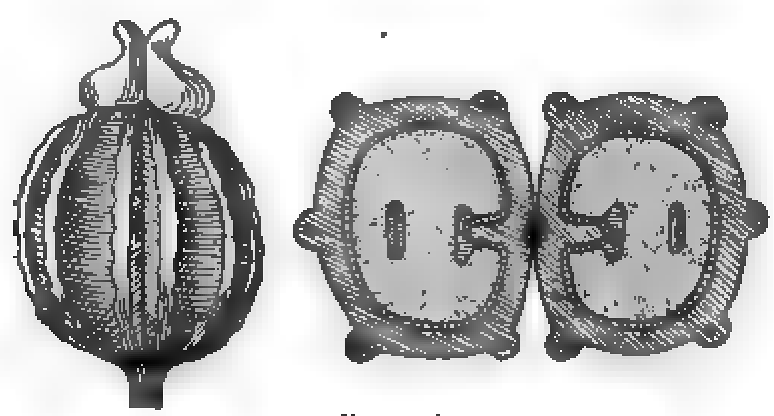


Fig. 375.

green, the mericarps usually remain adherent, although they are deeply notched along the sides; each fruit has five undulated ridges, which are somewhat lighter-colored than the grooves; *no oil-tubes;* on transverse section the seed (albumen) appears crescent-shaped, on account of being notched or grooved on the face side (Fig. 375); little odor or taste, but the odor becomes offensively disagreeable on the addition of solution of hydroxide of potassium.—**C.** A volatile alkaloid coniine, traces of volatile oil, some fixed oil, etc.—**U.** Narcotic, hypnotic, sedative, mainly in the insomnia of the insane. Dose: 0.1 to 0.3 gram.

In over-doses conium is a narcotic poison; the antidotal treatment consists in the use of the stomach pump or emetics, the internal use of stimulants and astringents, and the external use of friction, warmth, flagellation, etc.

Cari Fructus

N. *Carum,* Caraway.—**O.** The fruits of *Carum Carvi (Carui); Umbelliferæ.*—**H.** Europe and Northern Asia; wild and cultivated.—**D.** Elongated or oblong, compressed from sides, about

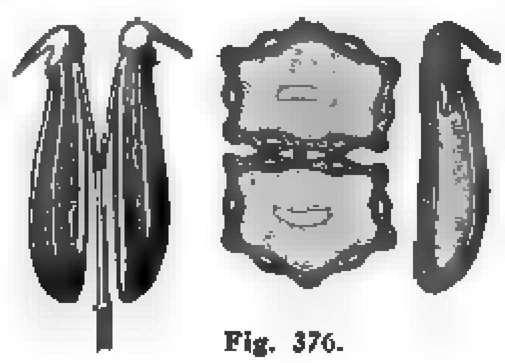


Fig. 376.

3 to 4 mm. long, smooth, brown; the two mericarps usually separate when ripe, and each of the fruits then curves towards the face at the top and base; each fruit has 5 obscure ridges, or rather angles, and 6 oil-tubes; odor pleasantly aromatic and taste sweetish spicy.—**C.** About 4 to 6 per cent volatile oil, some fixed oil, resin, etc.—**U.** Carminative, stimulant, stomachic; mainly used for flavoring. Dose: 1 to 2 grams.

Fœniculi Fructus

N. *Fœniculum,* Fennel.—**O.** The fruits of *Fœniculum vulgare; Umbelliferæ.*—**H.** Western Asia and Europe.—**D.** Elongated or

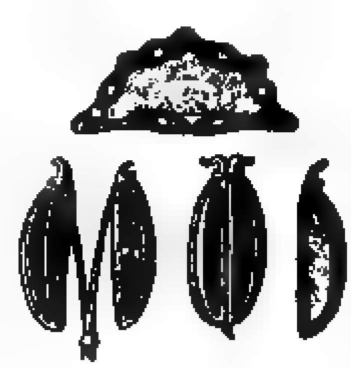


Fig. 377.

oblong, nearly cylindrical, about 4 to 5 mm. long, smooth, brown; the two mericarps readily separate when ripe, but the separated fruits rarely curve inwards; each fruit has a broad,

flat, pale-brown face, with longitudinal striæ, a curved back with 5 angular, pale-brown ridges between which are dark brown grooves under which lie the oil-tubes, of which each fruit has 4 on the back and 2 to 4 on the face; the odor is strongly aromatic and the taste sweetish aromatic.—**C.** About 2.5 to 4 per cent volatile oil, some fixed oil, resin, etc.—**U.** Carminative, stimulant, stomachic; mainly used for flavoring. Dose: 0.5 to 2 grams.

Roman fennel, from *Fœniculum dulce,* is nearly twice as long as the above-described German fennel, and is lighter-colored, more or less curved, slender, with sharp ribs. It has a sweeter and finer aroma than the German variety, but contains less volatile oil.

Petroselini Fructus

N. Parsley Fruit.—**O.** The fruits of *Petroselinum sativum; Apium Petroselinum; Umbelliferæ.*—**H.** Western Asia and Europe;

Fig. 378.

cultivated generally.—**D.** Roundish-ovate, compressed from the sides, about 2 mm. long, smooth, grayish-green; the two mericarps readily separate when ripe and dried; each fruit has 5 thin, light-colored ridges on the back, and contains 6 oil-tubes; odor and taste aromatic.—**C.** About 1 to 3 per cent volatile oil, apiin, apiol, some fixed oil, resin, etc.—**U.** Carminative, diuretic, stimulant, aromatic. Dose: 0.5 to 2 grams.

Anethi Fructus

N. *Anethum,* Dill.—**O.** The fruits of *Anethum graveolens; Umbelliferæ.*—**H.** Western Asia and Europe; cultivated generally.—**D.** Oval, compressed from back, about 3 to 4 mm. long, smooth, brown; the two mericarps readily separate when ripe; each fruit has 6 oil-tubes and 5 ridges of which the two lateral ones are

broad and thin, the others sharply angular; odor and taste spicy, peculiar.—**C.** About 3 to 4 per cent volatile oil, some fatty oil,

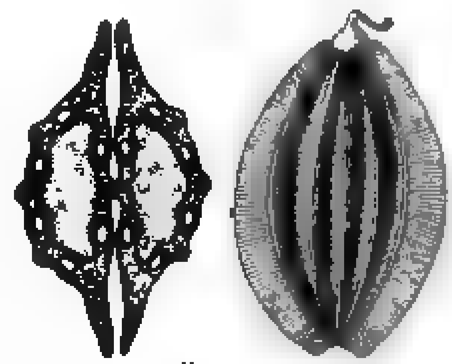


Fig. 379

etc.—**U.** Carminative, stimulant, stomachic; frequently used for flavoring pickles, etc. Dose: 0.5 to 2 grams.

Apii Fructus

N. *Apium*, Celery Seed.—**O.** The fruits of *Apium graveolens; Umbelliferæ.*—**H.** Western Asia and Europe; cultivated generally.—**D.** Roundish-ovate, compressed from sides, about 1 mm. in length, broader than long, smooth, brown; the two mericarps are usually separated in the drug; each fruit has five ribs and from 12 to 16 oil-tubes; odor and taste aromatic, peculiar.—**C.** About $1\frac{1}{2}$ to 3 per cent volatile oil, apiol, some fixed oil, resin,

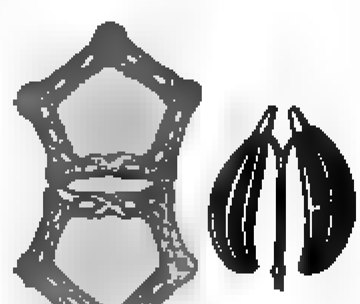


Fig. 380.

etc.—**U.** Emmenagogue; carminative, stimulant, stomachic; used for flavoring. Dose: 0.5 to 2 grams.

Levistici Fructus

N. *Ligustici Fructus*, Loveage Fruit, Loveage Seed.—**O.** The fruits of *Levisticum officinale (Ligusticum Levisticum); Umbelliferæ.*—**H.** Europe; cultivated in Germany.—**D.** Ovate-oblong or elliptic, flattened or compressed from back, about 4 to 5 mm.

long, yellowish-brown; in the drug the mericarps are usually separated; each fruit has five prominent ridges, the lateral ones

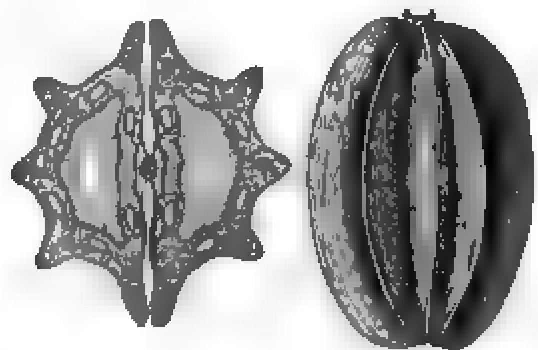


Fig. 381.

larger than the dorsal, and six oil-tubes; aromatic odor and taste.—**C.** Volatile oil, etc.—**U.** Aromatic stimulant, carminative, diaphoretic, emmenagogue. Dose: 0.5 to 2 grams, best in infusion.

Angelicæ Fructus

N. Angelica Fruit, Angelica Seed.—**O.** and **H.** The fruits of *Archangelica officinalis* (Garden Angelica); *Umbelliferæ.* This plant is a native of Northern Asia and Europe; cultivated. In America the similar fruit of *Archangelica atropurpurea,* which is

Fig. 382.

indigenous to the United States, is sometimes used as a substitute for the fruits of Garden Angelica.—**D.** Ovate or elliptic, flattened or compressed from back; about 4 to 5 mm. long, yellowish; in the drug the mericarps are usually separated; each fruit has three well-marked dorsal and two broad-winged lateral ridges and numerous oil-tubes; odor and taste aromatic.—**C.** Volatile oil.—**U.** Carminative stimulant; mainly used for flavoring. Dose: 0.5 to 2 grms.

Dauci Fructus

N. *Carota, Carotæ Fructus,* Carrot Fruit.—**O.** The fruits of *Daucus Carota; Umbelliferæ.*—**H.** Native of Asia and Europe; naturalized in North America; cultivated.—**D.** Oval, flattened or compressed from back, about 4 mm. long, grayish-brown; fruits

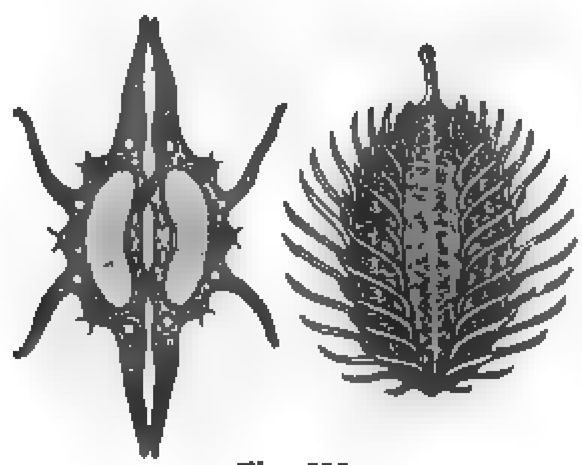


Fig. 383.

usually separated in the drug; each fruit has six oil-tubes and seven ridges, four of which are beset with bristly spines and the three intermediate ones with fine hairs; odor slightly and taste pungently aromatic.—**C.** Some volatile oil, fixed oil, etc.—**U.** Stimulant and diuretic. Dose: 0.5 to 2 grams, best in infusion.

GROUP LXIII

Fleshy Fruits, or Berries, Dried or Prepared

Drugs of this group and of Group LXIV, while botanically quite distinct, are not always easily differentiated, so that both groups must be considered together when trying to determine the identity of some unknown drug belonging here.

A *berry* is a fleshy fruit in which the seed or seeds (usually more than one) are imbedded; it is often the product of a compound pistil. The peculiarity of the berry is, that the hardness of the seeds (when they are hard) is due to the hardening of the seed-coats, as in the grape. The ovary in the berry has matured into a more or less fleshy mass, the rind of which usually remains thin and delicate, as in the currant or tomato, but may be tough and leathery as in the orange or lemon, or even hard as in the gourds; in the latter case the berry is designated as a *pepo.*

A *drupe* may resemble a berry very closely, and in fact, there seem to be transitional forms which it is difficult to place in either group without careful microscopical examination. The drupe is a fleshy, berry-like fruit in which the seed or seeds (usually only one) are imbedded, but the characteristic which distinguishes the drupe from the berry is, that while the outer and middle layers of the ovary develop into a more or less fleshy substance (sarcocarp) as in the berry, the inner layer of the ovary hardens into a "stone" (endocarp or putamen) in which the seed is contained,

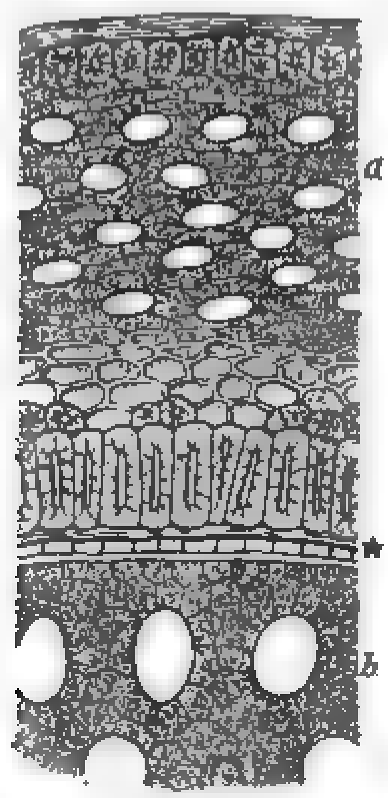


Fig. 384.

and commonly this stony layer is considered as part of the seed, as in the peach or plum.

If we carefully open or dissect the hard seed of a berry by removing the hard outer part, we find a naked embryo, or albumen containing the embryo, within; while, if we carefully examine the hard "seed" of a drupe, we find that after removal of the stony part, the seed within still has its seed-coats.

For example: Fig. 384 shows a microscopical section of a part of the fruit and seed of cubeb, the outer part of the fruit being above and the seed being below; in the drawing *a* shows a section of the fruit with sclerenchymatous cells or stone-cells of the inner layer of the fruit, and *b* shows the section of the seed; the

star shows the seed-coats of the seed. In black pepper, which is very closely related, botanically, to cubeb, we find no such hardening of the inner layer of the fruit, although the inner layer is intimately blended or grown together with the seed-coats, and black pepper is therefore a berry while cubeb is a drupe.

While it is perfectly easy to determine in the case of large fruits of pronounced structure, as between raisins and prunes, which is a berry and which a drupe, it is difficult to decide this matter in case of small fruits like black pepper and cubeb, pimento or buckthorn berries, etc.; and in fact, the latter, while called "berries" in the trade, are really compound drupes.

For practical purposes, therefore, no sharp distinctions need be made between drugs of these two groups, but both groups should be considered together, although, for abstract scientific reasons, a distinction is here made.

Juniperus, which is really a spurious fruit, or fleshy cone, belonging in Group LXI and there described, may be supposed to belong among the berries, and be looked for here; it is therefore mentioned.

See also drugs of Group LXIV.

Small, wrinkled, black berries, 3 to 4 mm. in diameter; pungently spicy .... **Piper Nigrum.**

Oblong-conical, glossy red berry, about 2 cm. long; taste very hot.................................. **Capsicum.**

Very light, spongy, white or yellowish-white, globular fruits, 5 to 10 cm. in diameter; very bitter........ **Colocynthis.**

Soft, shriveled, flattened berries, brownish, translucent; very sweet .... **Uvæ Passæ.**

Roughly granular, hard, grayish-brown berries with circular scar at base.............................. **Aurantii Fr. Immat.**

Small compound berries with 10 carpels, almost black; sticking together in lumps...................... **Phytolaccæ Fructus.**

Oval-oblong fruits, with 4-cleft calyx; odor clove-like.. **Caryophylli Fructus.**

Small round fruit resembling a berry, about 5 mm. in diameter, brownish-black with bluish bloom...... **Juniperus.**

Piper Nigrum

N. Pepper, Black Pepper.—**O.** The unripe fruit of *Piper nigrum; Piperaceæ.*—**H.** Native of India (Malabar), but cultivated also in Sumatra, Borneo, Siam and other tropical countries.—**D.**

A globular berry, without stalk, 3 to 4 mm. in diameter, wrinkled, brown to brownish-black, grayish-black or black; odor aromatic, taste pungently spicy.—**C.** About 1 to 2 per cent volatile oil, 4 to 6 per cent piperin, some resin, fat, etc.—**U.** Stimulant,

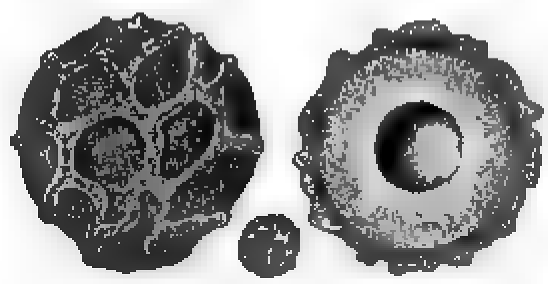


Fig. 385.

tonic, stomachic. Dose: 0.3 to 1.5 grams. Piperin is used as a febrifuge. Pepper is commonly used as condiment or spice. Fig. 385 shows fruit of pepper in natural size, and one whole and one in section, enlarged.

For White Pepper see Group LXV.

Capsicum

N. Capsicum, Cayenne Pepper, African Pepper, Bird Pepper, Chillies, Paprika.—**O.** The fruit of *Capsicum frutescens; Solanaceæ.*—**H.** Native of tropical America; cultivated in tropical and

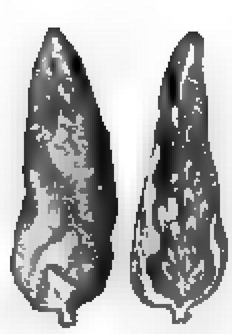


Fig. 386

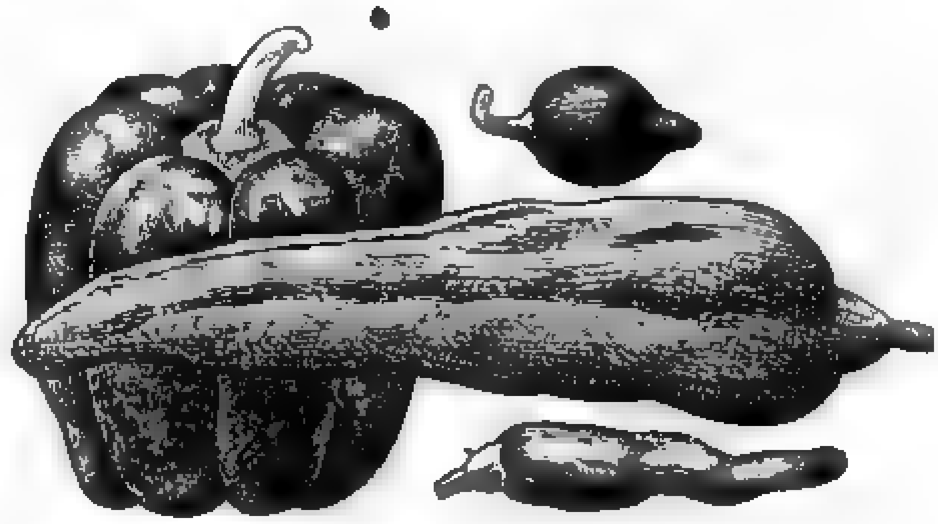


Fig. 387.

sub-tropical countries.—**D.** Oblong-conical berry (Fig. 386) about 1½ to 2 cm. and up to 3 cm. long, broadest at base which has a persistent, cup-shaped, five-toothed calyx; the fruit has glossy red or reddish-brown, leathery, somewhat translucent walls, and

two cells containing numerous flat, kidney-shaped, yellowish seeds attached to a thick central placenta, as shown in the drawing of a longitudinal section; odor peculiar, taste intensely hot and spicy.—**C.** Capsaicin, fixed oil, resin, etc.—**U.** Stimulant stomachic condiment; externally a powerful rubefacient and counter-irritant. Dose: 0.06 to 0.5 grams.

Formerly the fruits of *Capsicum annuum* were used; they are much larger and of various shapes (see Fig. 387), nearly cylindrical to subglobular or depressed; they are the "red peppers" of our markets and are used extensively for pickling and as condiment. By cultivation varieties have been produced which are quite mild in taste. A variety of red pepper, cultivated in Hungary, is called *Paprika.*

Colocynthis

N. Colocynth, Bitter Apple.—**O.** The fruit of *Citrullus* (*Cucumis*) *Colocynthis; Cucurbitaceæ.*—**H.** Southwestern Asia and North-

Fig. 388.

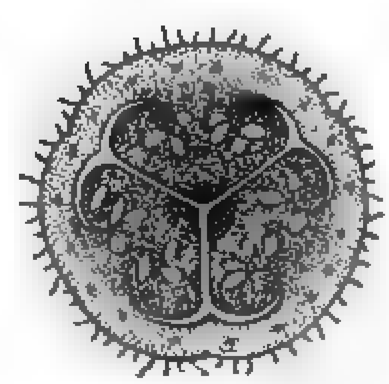


Fig. 389.

eastern Africa; cultivated especially in Greece and Spain.—**D.** The fruit is a gourd with a smooth, bright-yellow, leathery rind, which is removed when the fruit is gathered; the drug consists of the light, spongy pulp with the enclosed seeds. Globular, about 5 to 7 or even occasionally 10 cm. in diameter, white or yellowish-

white, light, spongy, porous, tough-elastic, with a three-cleft cavity within; easily breaks into three wedge-shaped pieces, each of which contains a large number of flat, ovate, yellowish or pale-brownish seeds near the outer rounded surface; no odor, taste intensely bitter.—**C.** About 0.6 per cent colocynthin, 4 per cent bitter fatty oil, 13 per cent bitter resin, 14 per cent bitter extractive, etc. (According to another authority it contains as much as 14 per cent of Colocynthin; they can hardly be referring to the same substance.)—**U.** Drastic hydragogue cathartic. Dose: 0.1 to 0.3 gram. Should be used with caution, as it produces severe and almost poisonous effects when given in too large doses. Fig. 388 shows a transverse section of colocynth; Fig. 389 shows a section of the ovary of the flower, to give an idea of the real nature of the structure.

Uvæ Passæ

N. *Passulæ majores,* Raisins.—**O.** The partially dried berry of *Vitis vinifera; Vitaceæ.*—**H.** The grapevine is a native of Western Asia; cultivated generally, but raisins are mainly produced in

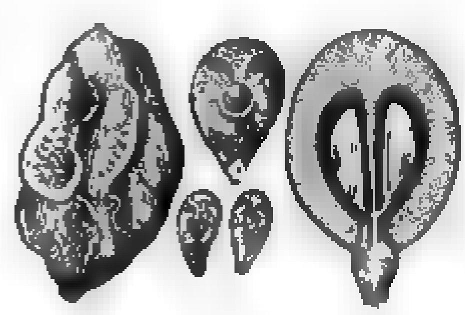


Fig. 390.

Southern Europe and California, from light-colored (red or amber-colored) and very sweet varieties of grapes.—**D.** Shriveled, flattened, soft berries; brownish or yellowish-brown, translucent; odor aromatic and taste agreeably sweet.—**C.** Grape-sugar, potassium tartrate, calcium tartrate, malic acid, etc.—**U.** Nutritive, demulcent, slightly laxative; sometimes added to purgatives as a corrective.

Raisins are not quite dried, but are preserved in their own sugar.

The better kinds of raisins consist of the entire clusters of

grapes. Inferior varieties consist of the berries separated from the stalks.

A seedless variety of raisins is common in the trade.

Passula minores, "Corinthians," or Corinthian raisins (commonly, but erroneously called currants) are the fruits of *Vitis minuta,* native in Greece (and formerly plentiful near Corinth, whence the name); they are small, black, seedless, very sweet berries, which, when ripe, are gathered, dried, after which they are packed closely in magazines and preserved by a process resembling ensilage. They occur in the trade in agglutinated masses.

Aurantii Fructus Immaturus

N. *Poma aurantii immatura, Aurantia immatura,* Orange Berries.—**O.** The unripe fruits of *Citrus vulgaris; Rutaceæ (Aurantiaceæ.*—**H.** Cultivated in subtropical countries.—**D.** Globular berries, averaging about 5 to 10 mm. in diameter, although both

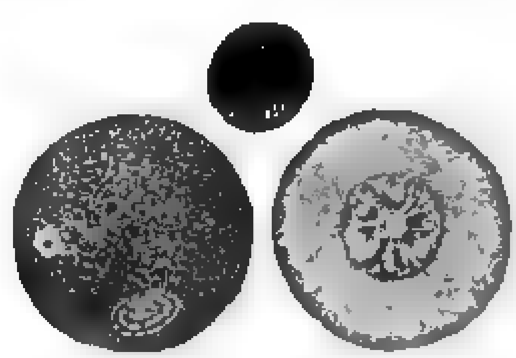


Fig. 391.

smaller and larger ones occur, roughly granular on the surface from the dried-up oil-glands, grayish-brown to greenish-black externally and pale-brown within, with a circular scar at the base, and containing 8 to 10 very small and hollow cells with undeveloped ovules along the central column; odor aromatic, taste bitter and aromatic.—**C.** The bitter glucoside hesperedin, volatile oil, etc.—**U.** Bitter tonic, stomachic and stimulant. Mainly employed in combination with other aromatics and bitters. **Dose:** 1 to 2 grams.

Fig. 391 shows one berry in natural size, an enlarged drawing of a whole berry, and also one of a transverse section.

Phytolaccæ Fructus

N. Poke Berry.—**O.** The fruit of *Phytolacca decandra; Phytolaccaceæ.*—**H.** A common, coarse, North American weed; naturalized in Europe.—**D.** The fruit is a compound berry of 10 carpels, each of which contains a small, black seed. Flattened or compressed globular, about 6 to 8 mm. in diameter and 5 mm. high,

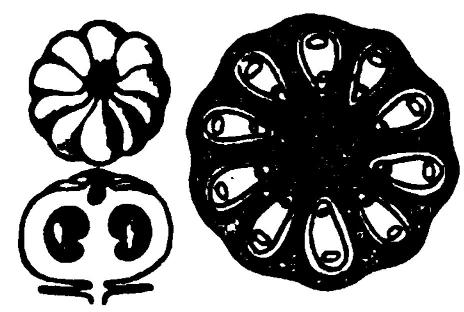


Fig. 392.

nearly circular almost black, with thin skin and juicy dark-red pulp; in the drug the berries are partially dried and usually agglutinated in masses; no odor, taste sweet, slightly acrid.—**C.** Sugar, gum, resin, coloring matter, etc.—**U.** Alterative and antirheumatic. Dose: 0.5 to 1 gram. Fig. 392 shows the berry in natural size, whole and in vertical section, and in transverse section enlarged.

Caryophylli Fructus

Anthophylli, or mother-cloves, are the partly developed berries of the clove-tree (see **Clove,** Group LIV). Oval, oblong, up to 3

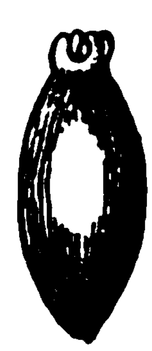


Fig. 393.

cm. long and 6 to 8 mm. thick, with persistent four-toothed calyx, wrinkled, generally 1-celled and 1-seeded, grayish-brown; odor and taste like those of cloves, but weaker.—**C.** and **U.** Similar to those of cloves; used to adulterate powdered cloves.

Juniperus has been described in Group LXI.

GROUP LXIV

Drupes, Dried or Prepared

See the introductory remarks to Group LXIII, where the structure of the drupe has been explained.

See also drugs of Group LXIII.

Globular, wrinkled, stalked, brownish-black drupe, 3 to 5 mm. diameter; odor and taste spicy........................**Cubeba.**
Oval, oblong or globular, bluish to blackish drupe, 3 to 4 cm. long; fruit-like odor and sweet taste....................**Prunum.**
Oval, occasionally compressed, somewhat angular, brownish-black to bluish-black drupe, 1.5 to 3 cm. long and 1 to 1.5 cm. in diameter.......................................**Sabal.**
Roundish, wrinkled, blackish-brown drupe, about 6 mm. diameter; odorless ....**Cocculus.**
Obscurely lobed, wrinkled, black fruit with four brown seeds, 5 mm. diameter; disagreeable odor, bitter taste..........**Rhamni Fr.**
Globular drupe, 5 mm. diameter, with 4-toothed calyx, reddish-brown; spicy ....**Pimenta.**
Oval or subglobular drupe, 3 mm. diameter, densely hairy, crimson; taste acidulous...............................**Rhus Glabra.**
Kidney-shaped drupe with grayish-brown rind and black acrid juicy pulp ....**Anacardium.**
Similar to last, but heart-shaped and darker brown..........**Semecarpus.**

Cubeba

N. Cubeb.—**O.** The fruit of *Piper Cubeba; Piperaceæ;* gathered before it is quite ripe.—**H.** Java; cultivated.—**D.** A globular drupe about 3 to 5 mm. in diameter, contracted at the base into a stalk

Fig. 394.

4 to 6 mm. long, from which reticulate wrinkles extend over the surface, and which cannot be separated from the fruit except by breaking it, gray, brown to blackish-brown externally, whitish

within and with its one seed not united with the putamen; odor spicy, taste pungently aromatic.—**C.** Up to 15 per cent volatile oil, some resin, etc.—**U.** Stimulant blennorrhetic, diuretic, expectorant. Dose: 1 to 8 grams.

Fig. 394 shows a fruit in natural size, an enlarged view of one whole, one in transverse, and one in longitudinal section, and a drawing showing location of embryo.

Prunum

N. Prune.—**O.** The prepared and partially dried fruit of any one of several varieties of the common plum, *Prunus domestica; Rosaceæ.*—**H.** Native of Western Asia, but cultivated generally; prunes are prepared in Southern Europe and California.—**D.**

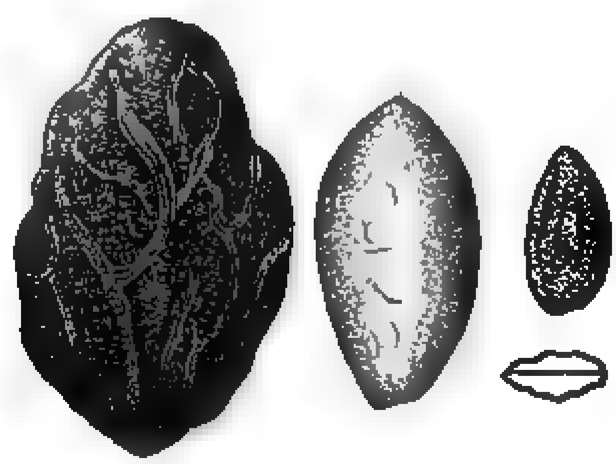


Fig. 395-*A*.

Oval, oblong or globular, about 2.5 to 4 cm. long, shriveled and wrinkled, purplish-blue to black externally, with soft brownish pulp surrounding an ovate flat stone which encloses the seed; fruit-like odor and sweet acidulous taste. Fig. 395A shows a whole prune, its stone and the seed whole, and in transverse section.—**C.** Sugar, fruit acids, etc.—**U.** Nutritive, laxative, frequently used as a corrective with senna, but mainly as a food.

Sabal

N. Sabal, Saw Palmetto, Saw Palmetto Berries.—**O.** The partially dried fruit of *Serenoa serrulata; Palmaceæ.*—**H.** Atlantic coast states of U. S., from S. Carolina to Florida.—**D.** Oval or ovoid-oblong drupe, irregularly shrivelled and angular, brownish-black to bluish-black, 1.5 to 2.5 cm. long and 1 to 1.5 cm. thick,

outer skin thin and somewhat oily, flesh soft and spongy, greenish-yellow, glutamen thin and fragile, seed hard and dark brown; taste sweetish, acrid and oily and odor aromatic.—**C.** Action depends upon a fixed oil, about 1½ per cent.—**U.** Stimulant blen-

Fig. 395-B.

norrhetic in genito-urinary troubles; similar in action to copaiba and cubeb, but milder. Dose: 0.5 to 1.5 grams, best administered as fluid extract.

Cocculus

N. *Cocculus Indicus;* Fish-berry.—**O.** The drupaceous fruit of *Anamirta Cocculus: Menispermaceæ.*—**H.** East India, Ceylon, Java, etc.—**D.** Obscurely kidney-shaped, roundish, about 8 mm. in diameter, wrinkled, apex and base near together, blackish-brown externally, reddish-brown within, the skin and pulp brittle, the

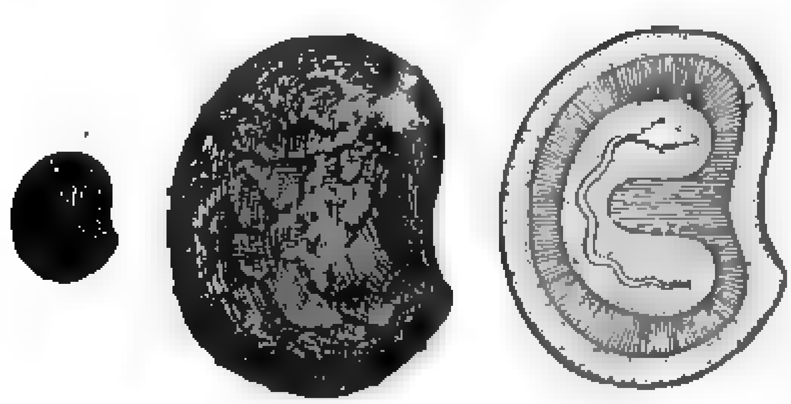


Fig. 396.

stone pale brown; odorless, the fleshy part tasteless, but the seed bitter and poisonous.—**C.** Picrotoxin, resin, etc.—**U.** Sedative. Dose: 0.1 to 0.2 gram.

It is called "fish-berry" because it is sometimes fed to fishes in bait to stupefy them, so that they may be more readily caught.

Rhamni Catharticæ Fructus

N. Buckthorn Berries.—**O.** The drupaceous fruit of *Rhamnus cathartica; Rhamnaceæ.*—**H.** Northern temperate zone; indigenous to the Eastern hemisphere, naturalized in America.—**D.** When fresh the fruit is round, supported on a circular disk, the parchment-like endocarp 4-celled (more rarely 2, 3 or 5-celled) and 4-seeded, black externally, greenish within; owing to the thin flesh this dries so that the whole fruit assumes the shape of the endocarp and appears lobed or furrowed; the dried fruit as it occurs in the drug is deeply wrinkled, about 5 mm. in diameter, with a fragile stalk, a brownish-green pulp, and with brown seeds that are triangular-rounded, with a deep furrow on the back so

Fig. 397.

that a section of one appears horseshoe-shaped; faint but disagreeable odor and taste bitter and acrid. When chewed the fruits color the saliva greenish. -**C.** Rhamnocathartin, sugar, gum, etc.—**U.** Brisk hydragogue cathartic. Dose: 2 to 5 grams, best as fluid extract.

Fig. 397 shows fruit and seed in natural size and enlarged, and in section.

Pimenta

N. Pimento, Allspice.—**O.** The nearly ripe fruit of *Pimenta officinalis (Eugenia Pimenta); Myrtaceæ.*—**H.** Indigenous to West Indies; cultivated in tropical America and in India.—**D.** A globular or obscurely quadrangular drupe, about 5 mm. in diameter, surmounted by a four-toothed calyx and the remains

of the style, warty granular, grayish or reddish-brown, 1 or 2-celled, each cell containing one seed which is plano-convex when there are two in a fruit; odor and taste pungently spicy, resembling cloves.—**C.** About 4 per cent volatile oil, some resin, etc.—**U.** Aromatic stimulant, mainly employed as a spice. Some-

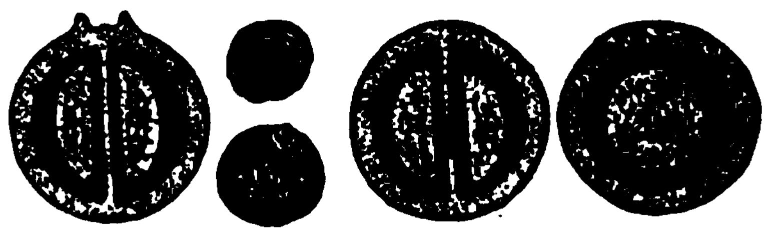


Fig. 398.

times used as fluid extract in doses 0.5 to 2 grams. Also used whole in "hot spiced wine" (German: "Glueh-wein").

Fig. 398 shows the fruit and seed in natural size and enlarged, and in longitudinal and transverse sections.

A variety of *Eugenia (Myrtus)* is indigenous to Mexico, *Myrtus Tabasco;* this plant furnishes a variety of allspice which is larger than the more common variety described above, but it is used for the same purposes as the latter.

Rhus Glabra

N. *Rhois Glabra Fructus*, Sumach Berries.—**O.** The drupaceous fruit of *Rhus glabra; Anacardiaceæ.*—**H.** North America.—**D.** Oval

Fig. 399.

or subglobular, about 3 mm. in diameter, bright crimson to brownish, densely hairy, containing an oblong-roundish, gray, hard stone surrounding the seed; no odor, taste acidulous.—**C.** Tannin, potassium malate, etc.—**U.** Slightly acidulous and refrig-

erant, and mildly astringent. Dose: 2 to 5 grams, best given in the form of fluid extract. The infusion is also used as a gargle.

Fig. 399 shows a fruit in natural size and two, one from the side and one from the edge, enlarged; also, on the left, some of the hairs and glands, much enlarged.

Anacardium

N. *Anacardium occidentale,* Cashew Nut.—**O.** The drupaceous fruit of *Anacardium occidentale; Anacardiaceæ.*—**H.** Indigenous to

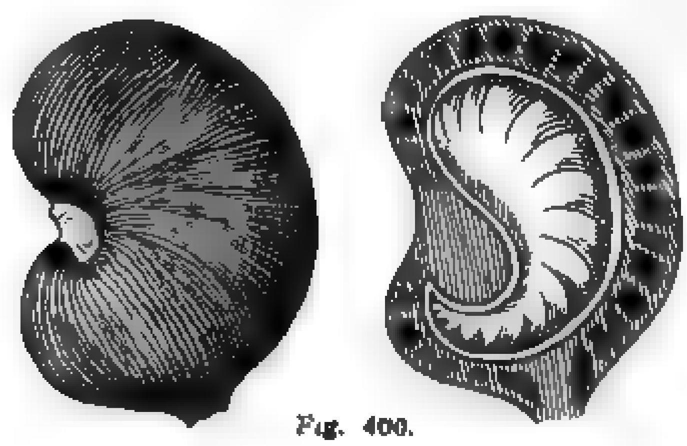


Fig. 400.

tropical America; naturalized in Africa and the East Indies.—**D.** Shape and size are well shown in the drawings of Fig. 400. A kidney-shaped, grayish-brown drupe, 2 to 3 cm. long, about 2 cm. broad and 6 to 8 mm. thick, glossy black, 1-celled and 1-seeded; this drupe resembles a nut because the outer part of the sarcocarp or flesh is hardened into a brittle rind (the exocarp)

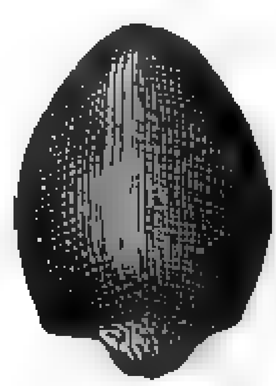


Fig. 401.

which is connected to the putamen or stone, but so that there are many cavities in this layer (the mesocarp) in which there is a black, acrid juicy pulp; the seed consists of two white cotyledons enveloped by brown seed-coats.—**C.** A yellowish, oily, acrid

substance which is more vesicating than cantharides. The kernel contains a bland fixed oil.—U. The kernel, raw or roasted, is edible. The pulp or juice is a local irritant; it is sometimes employed to destroy warts and excessive granulation tissue. The oil has been used as a vermifuge in doses of 0.2 gram (3 drops).

Anacardium orientale, *Semecarpus,* or Oriental Cashew Nut (from *Semecarpus Anacardium; Anacardiaceæ),* from East India, is heart-shaped, flattish, blackish-brown, but otherwise similar to the true cashew nut in its structure, constituents and properties. (See Fig. 401).

GROUP LXV

Parts of Fruits

With three exceptions the drugs of this group consist mainly of the rinds of fruits. These exceptions are tamarinds, white pepper and pearled barley, the first being the inner pulp, fibers and seeds of a fruit with the hard external shell or rind removed, the second being a berry with the external pulpy flesh partly removed, but with some fibro-vascular bundles and dried pulp still adhering to the outer surface of the seed, and the third being a grain from which the hulls and outer portions were removed, the inner mealy part then polished.

In regard to the rinds it is to be regretted that in Latin nomenclature no difference is made between "barks" and "rinds," but that the word "cortex" is used for both; while not likely to cause confusion, it is not as exact a use of words as is desirable in scientific work, and it would be better to use distinctive words whenever possible. Possibly some variant of the word *tegmen* (used to designate the inner seed-coat) might by common consent be used for "*rind*," for instance: *Tegmentum* or *tegumentum;* in that case *tegmen* might still mean "seed-coat" and its meaning would not be interfered with by *tegmentum* meaning "fruit-coat." Strictly speaking, *limon* is the lemon tree; *limonis cortex* could therefore mean "the bark of the lemon tree" as well as "the peel of the lemon." *Limonia* is the lemon; lemon peel therefore would be better expressed by the Latin words *limonia tegmentum.* Similarly, *Aurantii cortex* literally translated, might be "bark of the orange tree."

Brownish-black pulp mixed with tough fibers and glossy brown seeds; acidulous vinous odor.....**Tamarindus.**

Globular, about 2 to 3 mm. in diameter, grayish-white; peppery taste..........................**Piper Album.**

Rind of fruit, in quarters, dirty brownish-green on outer and dirty white on inner surfaces; fragrant ....**Aurantii Amari Cortex.**

Rind of fruit in spiral bands, dirty brownish-green on outer surface, with little whitish parenchyma on inner surface; fragrant....................**Aurantii Amari Cortex.**

Rind of fruit, in quarters, orange-colored on outer, white on inner surfaces; fragrant.............**Aurantii Dulcis Cortex.**

Rind of fruit in spiral bands, lemon-yellow on outer, white on inner surfaces; fragrant.............**Limonis Cortex.**

Irregular leathery fragments of reddish-brown rind, some pieces with hard, long, tubular calyx, and most pieces with oval depressions on inner surface; no odor...............................**Granati Fructus Cortex.**

Fragments of fruit, hard brownish-gray rind, to the inner side of which dried pulp with seeds adheres; no odor..............................**Belæ Fructus.**

Hard, thick, deep brown rind, without adhering pulp, with remains of six-rayed stigma and of hard calyx; no odor.........................**Mangostana.**

Oval grains, about 3 to 4 mm. long, yellowish-white, whiter at ends, yellowish-brown groove along one side ....**Hordeum Perlatum.**

Tamarindus

N. Tamarind.—**O.** The preserved pulp of the fruit of *Tamarindus Indica; Leguminosæ.*—**H.** East India, North Africa, West Indies, etc.—**D.** The fruit is an indehiscent legume, up to 10 or 12 cm. long, about 3 cm. broad and 1½ cm. thick, with a brownish pulp and 3 to 12 seeds. The drug consists of the brownish to brownish-black pulp composed of parenchyma cells mixed with strong, branching, fibrous bundles, and flattish, subquadrangular, glossy brown seeds, each of which is enclosed in a tough membrane; fruity odor and sweetish acidulous taste; see Fig. 402, which shows seeds whole and in sections.—**C.** About 9 per cent citric acid, 1½ per cent tartaric acid, 3 per cent bitartrate of potassium, some malic acid, 12 per cent sugar, pectin, gum, etc.—

U. Tamarind pulp dissolved in water makes a pleasant, acidulous, slightly laxative drink. Tamarinds are occasionally added to

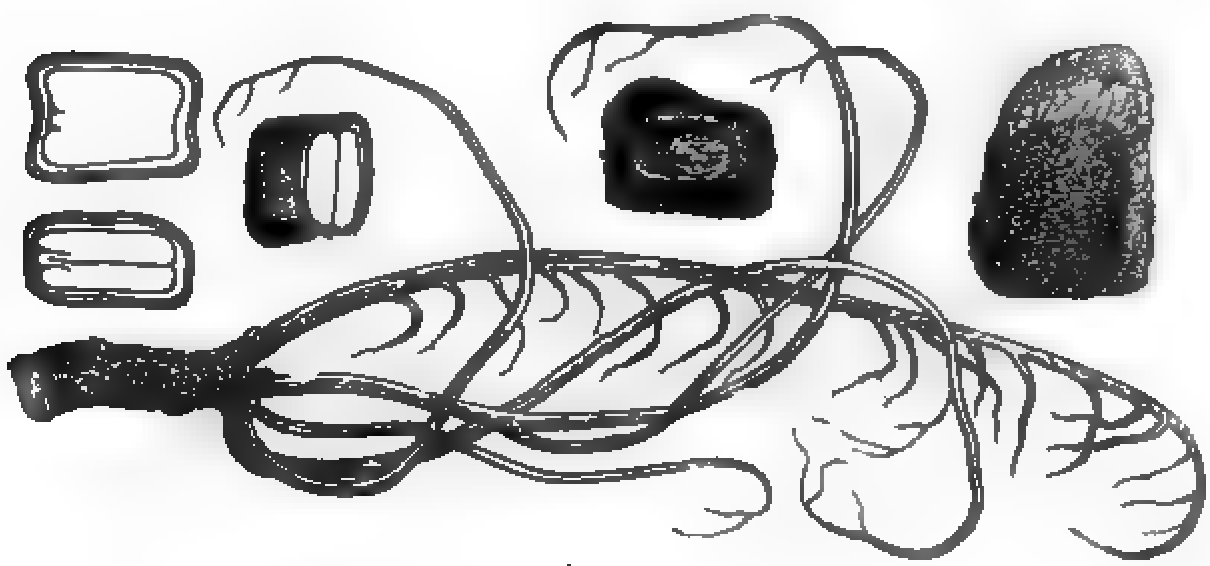


Fig. 402.

other cathartics. Dose: 10 to 20 grams or more; practically *ad libitum.*

Piper Album

N. White Pepper.—**O.** The ripe seeds of *Piper nigrum* (see **Piper nigrum,** Group LXIII), with the inner portion of the fruit-pulp adhering, or "the ripe fruit of *P. nigr.* with the outer and middle layers of the fruit-pulp removed." The ripe berries of black pepper are soaked in water, after which they are dried in the sun and then gently rubbed between the hands to remove

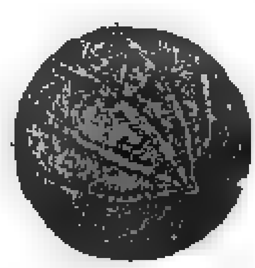


Fig. 403.

the dark outer portion, but so that much of the soft white flesh of the berry remains adherent to the seed.—**D.** White pepper is globular, 2 to 3 mm. in diameter, dirty white to yellowish-brown, smooth, with about 10 veins (fibro-vascular bundles of the fleshy pulp) running from base to apex; the seed itself, after removal of the whitish remains of the fruit parenchyma, is reddish-brown

and contains a large albumen in which is imbedded the small embryo; odor, taste, constituents and uses like those of black pepper, except that it is less pungent and spicy.

Fig. 403 shows one grain of white pepper enlarged.

Aurantii Amari Cortex

N. *Aurantii Amari Tegmentum.* Bitter Orange Peel.—**O.** The rind of the fresh fruit of *Citrus, Citrus Aurantium amara; Ruta-*

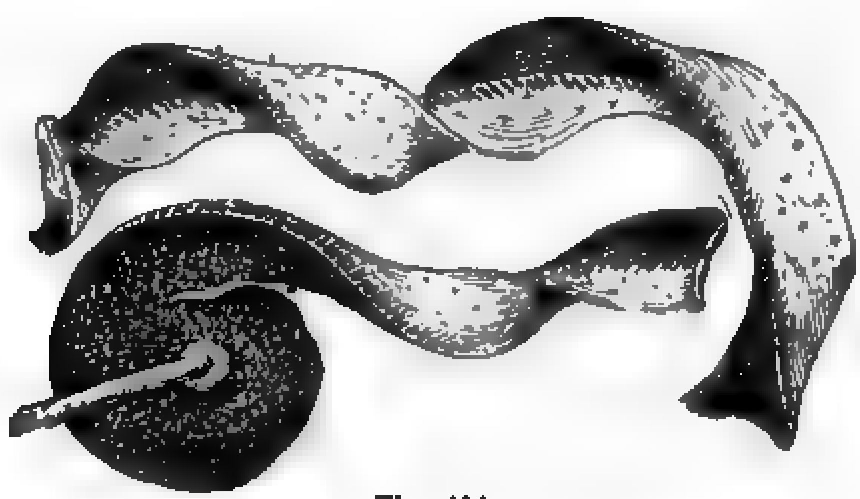


Fig. 404.

Fig. 405.

ceæ. (*Aurantiaceæ*).—**H.** Cultivated in subtropical countries.—**D.** In spiral band ("ribbons") or in quarters; glandular and dark brownish-green externally, with a thin layer of white spongy parenchyma on the inner surface; odor fragrant, taste very bitter.—**C.** About 1 per cent volatile oil, a bitter principle hesperidin, etc.—**U.** Bitter tonic, stomachic, stimulant carminative. Dose: 2 to 5 grams.

The spiral bands (Fig. 404) are made by peeling with a knife and contain less of the spongy parenchyma than does the peel in quarters (Fig. 405).

The best bitter orange peel is that obtained from the rather small fruit of a variety of orange grown on the Island of Curaçao, in the West Indies. "Curaçao Orange Peel" is shown in Fig. 405; it has externally a dirty green, internally a dirty whitish color. Next in quality is the peel from an orange grown in Southern France, which is said to be green when ripe. Much of the so-called "Curaçao peel" sold in the trade is probably not from either of these sources, but from unripe oranges grown in Southern Europe.

Aurantii Dulcis Cortex

N. *Aurantii Dulcis Tegmentum,* Sweet Orange Peel.—**O.** The rind of the fresh fruit of *Citrus Aurantium sinensis; Rutaceæ (Au-*

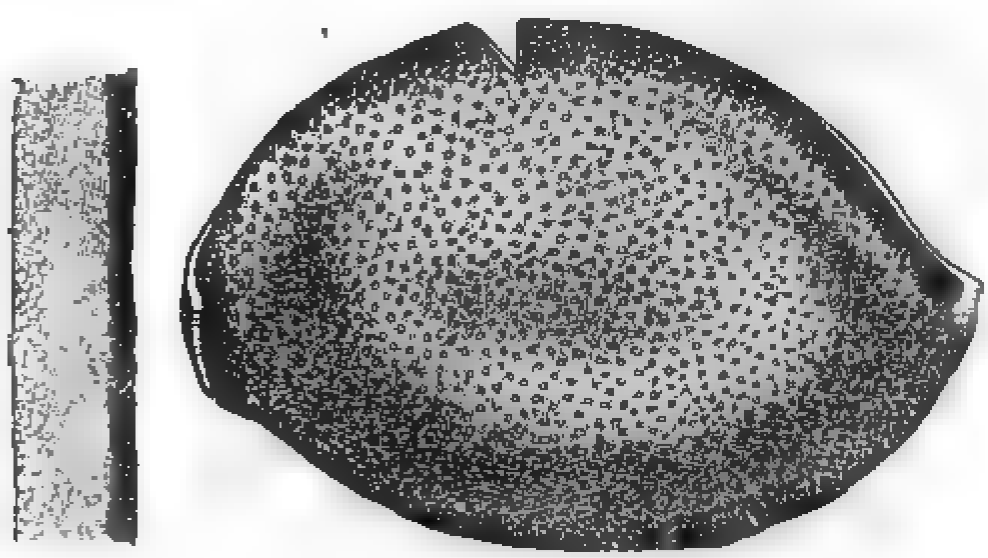


Fig. 406.

rantiaceæ.—**H.** Cultivated in subtropical countries, Southern Europe, West Indies, Florida, California, etc.—**D.** The rind of the fruit is usually removed in quarters and is glandular rough and orange yellow on the outer surface, whitish on inner surface; a section shows intercellular oil-glands or spaces near the outer surface and a loose, spongy, white parenchyma (consisting of peculiar branched cells) within; odor fragrant, taste aromatic and slightly bitter.—**C.** Volatile oil, hesperidin (much less than in bitter orange peel), etc.—**U.** Stimulant carminative and stomachic, but employed mainly as an excipient and flavoring agent.

Granati Fructus Cortex

N. *Granati Fructus Tegmentum,* Pomegranate Rind.—**O.** The rind of the fruit of *Punica Granatum; Punicaceæ.*—**H.** Grows wild in Northern Africa and Southern Asia and Europe; cultivated in all subtropical countries.—**D.** The illustration (Fig.

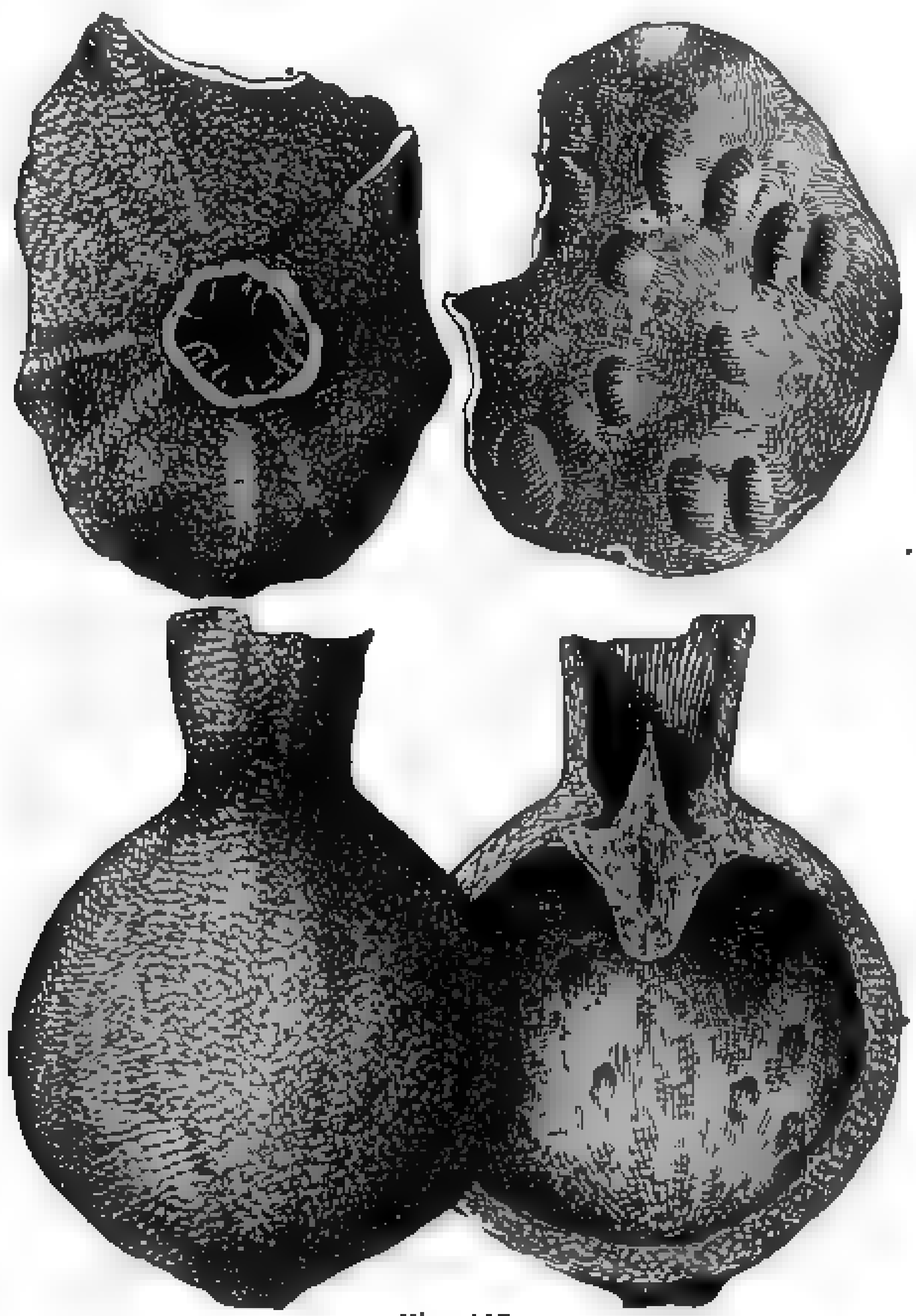


Fig. 407.

407) shows the fruit whole and in longitudinal section (with seeds removed), and two fragments as they are found in the drug, all natural size; the rind occurs in irregular fragments from 1 to 2 mm. thick, leathery, breaking with granular fracture, reddish-brown or brownish-red externally, lighter on the inner surface; some of the pieces have the tubular persistent calyx attached and

all are more or less marked on the inner surface with depressions caused by the seeds; without odor, taste astringent.—**C.** About 28 per cent tannin.—**U.** Astringent. Used internally or locally as a gargle or wash, in diarrhœas and relaxed conditions of the mucous membranes generally. Dose: 1 to 2 grams.

Belæ Fructus

N. *Bela,* Bael Fruit, Bengal Quince.—**O.** The unripe fruit of *Aegle Marmelos; Rutaceæ (Aurantiaceæ).*—**H.** Cultivated in East

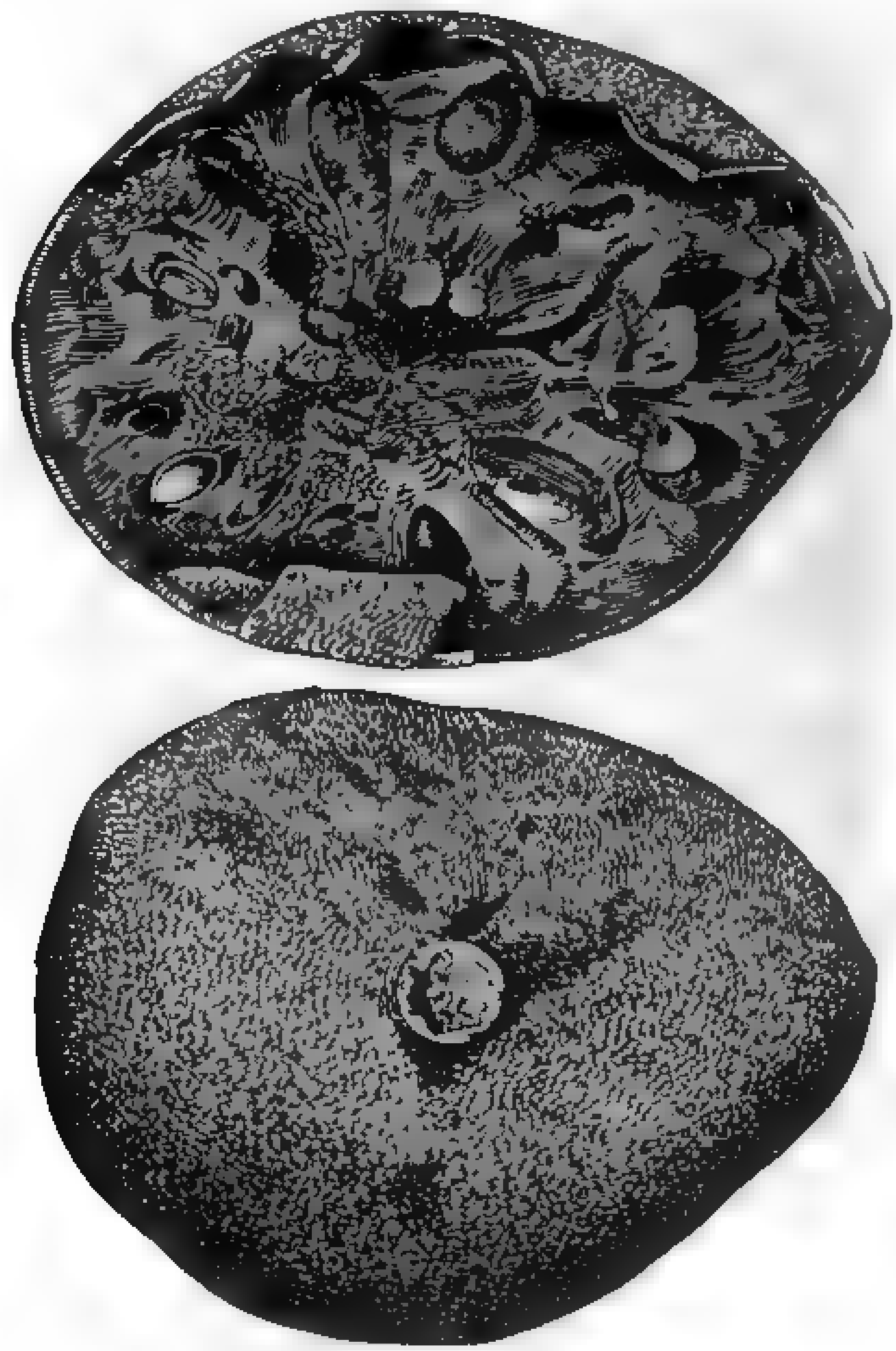


Fig. 408.

India.—**D.** The fruit is orange-shaped, 5 to 10 cm. in diameter, and about 10 to 12-celled, but as found in the trade it is broken. The drug consists of irregular fragments (see Fig. 408); the rind is about 2 to 3 mm. thick, smooth, hard, and brownish-gray externally; the dried pulp, which adheres to the rind, is hard, reddish-brown, whitish within, mucilaginous, acidulous, and encloses oblong, flat, hairy seeds; no odor, taste slightly astringent.—**C.** A small quantity of tannin, some mucilage, sugar, etc.—**U.** Mildly astringent, aromatic and demulcent. Dose: 2 to 5 grams.

Mangostanæ Fructus

N. *Mangostanæ Fructus Tegmentum, Mangostana,* Mangosteen.—**O.** The rind of the fruit of *Garcinia Mangostana; Guttiferæ.*—**H.** East India.—**D.** The fruit is about the size and form of a small orange; it is prepared for trade by breaking the fruit and removing the pulp from the pieces; the drug consists of irregular fragments of rind (see Fig. 409), about 5 to 6 mm. thick, hard and smooth, dark brown and mottled; some of the pieces have adhering remains of the persistent calyx, others have the remains of a prominent, thickened, radiate stigma; inodorous, taste astringent and bitter.—**C.** Tannin and a crystallizable bitter principle.—**U.** Powerfully astringent; useful in diarrhœas, dysentery, etc. Dose: 1 to 5 grams.

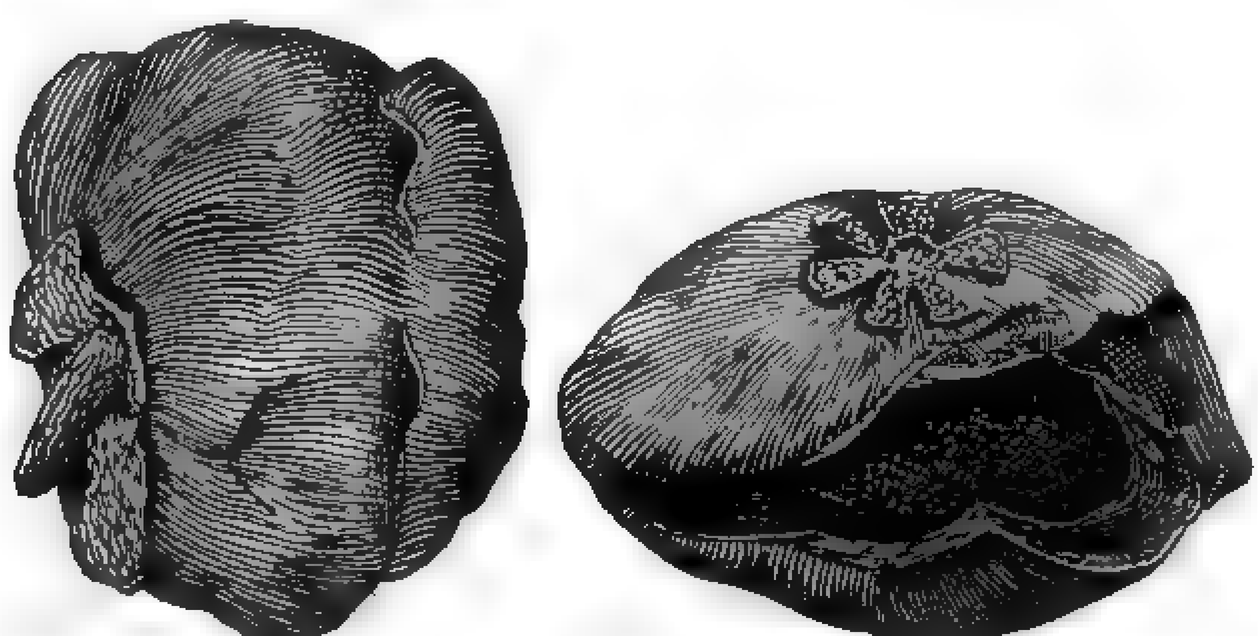


Fig. 409

Limonis Cortex

N. *Limonis Tegmentum*, Lemon Peel.—**O.** The rind of the fruit of *Citrus medica Limonum; Rutaceæ (Aurantiaceæ)*.—**H.** Cultivated in subtropical countries.—**D.** In spiral ribbons or bands, resembling in shape the rind of the bitter orange figured above; as the rind of the lemon cannot be separated from the fruit except by peeling with a knife, lemon peel occurs only in this one form; the bands are thin, deep lemon-yellow, and glandular on the outer and whitish on the inner surface; odor fragrant and taste aromatic and somewhat bitter. For pharmacopœial preparations this rind should be freshly grated, from the fresh fruit.—**C.** Volatile oil, hesperidin, etc.—**U.** Stimulant, carminative and stomachic, but employed mainly as an excipient and flavoring agent.

Hordeum Perlatum

Pearl Barley is the fruit of *Hordeum distichum* (nat. ord.; *Graminaceæ*) deprived of the seed-coats. There are two varieties

Fig. 410.

in the grocery trade; in one the ends are rounded off and the seed-coats removed, so that the grains are ovate, whitish, mealy, with a groove on one side in which are remnants of the yellowish-brown seed-coats; in the other the barley grain is probably cut in two and the fragments are then rounded, forming small, globular, white, mealy grains. Pearl Barley is used as an article of diet and to make demulcent drinks for the sick. Rarely used medicinally.

The illustrations show both kinds of pearled barley in natural size, and one grain of each kind enlarged.

SEEDS

To understand the structure of seeds we must first consider the structure of ovules. In the drawings in Fig. 411 we see, on the left, a section of a straight (orthotropous) ovule, much enlarged,

in which *a* is the nucleus, *b* the inner and *c* the outer ovule-coats, *d* the place of junction of nucleus, ovule-coats, and stalk, which is called *chalaza; f* is the orifice through which the end of the pollen-tube reaches the embryo sac; the ovule may be sessile or it may have a stalk; this stalk, *e*, is called the *funiculus*. The figure on the right shows an inverted (anatropous) ovule, in which the funiculus is bent and united to one side of the ovule, the ridge thus formed being called the *rhaphe* or seam. When the ovule matures, after fertilization, it forms a *seed;* the nucleus becomes developed either into an *embryo* alone, or into an embryo imbedded in and surrounded by the *albumen*, also called *endosperm* or *perisperm;* in the first case the nourishment needed by the germinating plantlet is stored in the embryo or young plant itself and the kernel of such seeds consists mainly of the cotyledons, with the

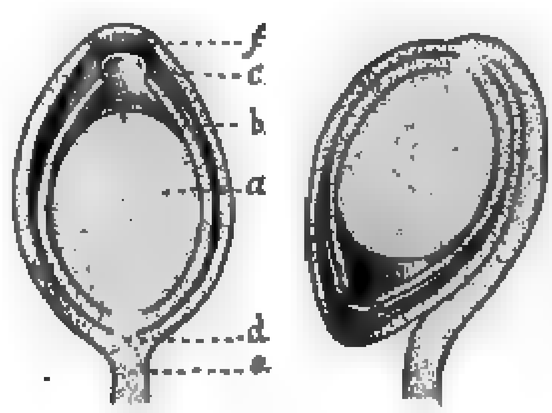


Fig. 411.

radicle and sometimes a more or less developed plumule; in the second case the nourishment is in the albumen which surrounds the embryo. The ovule-coats develop into the seed-coats, which sometimes remain as separate coats, sometimes become united so as to apparently form only one coat.

The growing seed obtains its nourishment from the placenta of the ovary (maternal organ) through the funiculus, and this funiculus of the plant is, therefore, analogous to the funiculus or umbilical cord of the human or animal embryo or fœtus, which also unites the developing young to the tissues of the mother through the placenta. When the seed is ripe it separates from the funiculus and thereby from the maternal tissues, and at the point where the funiculus was attached a scar or mark is left which is called the *hilum*, and which corresponds or is analogous to the navel of mammals.

Under the epidermis of the cotyledons of many seeds, as well as under the epidermis of young twigs, petioles and midribs of leaves, etc., we sometimes find a peculiar kind of cell and of tissue, as shown in Fig. 412. To support the tender epidermis there may be developed from the fundamental tissue certain hard-walled cells, as for instance the sclerenchymatous cells under the epidermis of sarsaparilla root, or the stone cells which constitute the outer layer of the middle bark of cinnamon, or the sclerenchymatous cells under the epidermis of the fruit of cubeb. But in some cases, especially in the positions referred to above, the walls of such supporting cells for the epidermis become thickened very much in the angles of the cells and but little else-

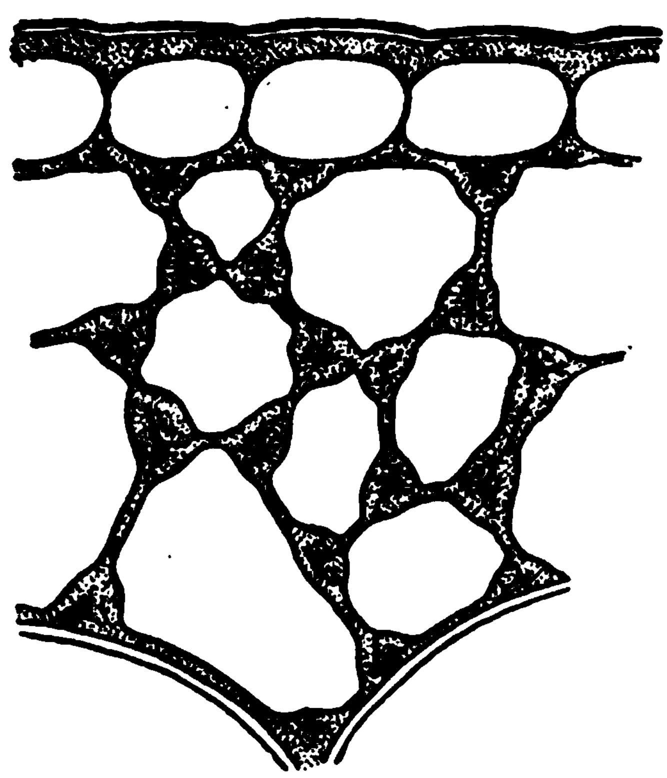


Fig. 412.

where; these cells are called *collenchymatous* cells and the tissue formed by them constitutes *collenchyma* or *collenchymatous tissue*. This kind of cell and tissue is, however, of quite subordinate importance to the pharmacognosist, but may sometimes help in recognizing powdered seeds, or powdered leaves.

GROUP LXVI

Whole Seeds

The presence or absence of albumen in the seeds is made the basis for dividing seeds into groups by many of the authors on pharmacognosy; the first figure, on the left, shows a section of pumpkin seed, the second, the embryo of the same seed both in

natural size, showing that the embryo occupies all the space within the seed-coats; the figure on the right shows a section of colchicum seed, much enlarged, in which the small embryo (*b*) is seen in the large mass of albumen (*a*).

We will make this a subordinate basis of grouping seeds, but without placing much stress on the subject; we will base our main division on the size of seeds, and while this may be considered less "scientific" by some, it will be found to be more practical because it makes the recognition of seeds easier and more certain; and in a case of this kind mere abstractly scientific considerations should be subordinated to considerations of practical utility.

We, therefore, divide seeds into subgroups, as follows: *Large*, more than about 15 mm. long; *medium-sized*, less than about 15

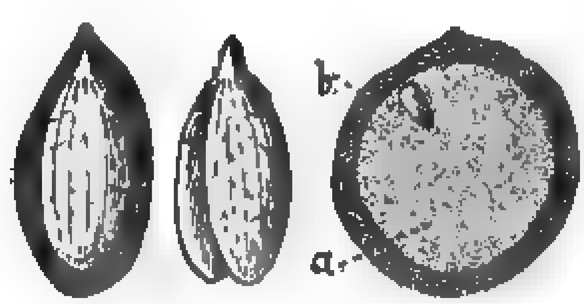


Fig. 413.

mm. and more than about 5 mm. long; and *small*, less than about 5 mm. long. Each of these subgroups is again divided: (1) ***With well-marked albumen***, and (2) ***with little or no albumen.***

LARGE	*Well-marked albumen*	Myristica, Nux vomica, Ignatia, Areca.
	Little or no albumen	Amygdala, Physostigma, Theobroma, Dipterix, Citrullus, Pepo, Strophanthus.

MEDIUM-SIZED	*Well-marked albumen*	Caffea, Staphisagria, Sabadilla.
	Little or no albumen	Cydonium, Cucumis, Abrus.

Small	*Well-marked albumen*	Cardamomi Semen, Colchici Semen, Stramonii Semen, Hyoscyami Semen, Lobeliæ Semen, Papaveris Semen, Delphinium, (Piper Album).
	Little or no albumen	Linum, Sinapis Nigra, Sinapis Alba, Rapæ Semen, Fœnum Græcum.

In examining drugs of this group we must bear in mind, however, that quite a number of the drugs of Group LXII (dry fruits) are called "seeds" in the trade, such as the cremocarps ("anise-seed," "caraway-seed," etc.), "canary-seed," "hemp-seed," and others; most of these are readily recognized as fruits and therefore do not belong here. Both names and appearance of Santonica and Chenopodium (both "worm-seeds" in the trade) may mislead and some might look in this group to find them; Santonica was described in Group LII, and Chenopodium in Group LVI. The spores of Lycopodium are sometimes called "semen lycopodii," but in this case only the name is misleading, for the drug cannot be mistaken for seeds.

Large Seeds

With well-marked albumen

Oval, about 2.5 cm. long, netted-veined, with white markings from lime-dust, marbled within .... **Myristica.**

Round, flat, disk-like seeds, up to 2.5 cm. in diameter and 4 mm. thick; gray and very hard .... **Nux Vomica.**

Irregularly ovate and angular, about 3 cm. long, brownish-black and very hard .... **Ignatia.**

Short rounded cone with flattened base; about 2.5 cm. long; brownish with network of reddish veins; heavy, hard .... **Areca.**

Little or no albumen; two cotyledons

Ovate, flattened, pointed above, obtuse below; 2 to 2.5 cm. long; externally brown, white within; agreeable nut-like taste .... **Amygdala Dulcis.**

Appearance like last, but taste bitter with flavor of oil of bitter almonds.................................**Amygdala Amara.**
Oblong, somewhat kidney-shaped, 2.5 to 3 cm. long; chocolate-brown, with broad black groove on convex side ....**Physostigma.**
Oval, about 2 to 2.5 cm. long; with thin, fragile, reddish-brown shell ....**Theobroma.**
Oblong, 4 to 5 cm. long; blackish-brown, wrinkled; odor vanilla-like ....**Dipterix.**
Oval, flat, about 1.5 cm. long; black, brownish-black or pale yellowish-brown with black edges............**Citrullus.**
Oval, flat, about 2 cm. long; whitish...................**Pepo.**
Oblong-lanceolate, obtusely two-edged, 1.5 to 2.5 cm. long; grayish-green, silky hairy..................**Strophanthus.**

MEDIUM-SIZED SEEDS

With well-marked albumen

Plano-convex, oval, grooved on flat side; about 1 cm. long; greenish-brown ....**Caffea.**
Flattish-tetrahedral, about 5 to 7 mm. long, externally reticulately ridged; brownish.....................**Staphisagria.**
Lanceolate, angular, about 6 mm. long, 1.5 to 2 mm. thick at thickest end; glossy brownish-black; often mixed with the 3-celled capsules..................**Sabadilla.**

Little or no albumen; two cotyledons

Ovate or ovate-oblong, triangularly compressed, about 8 mm. long; brown, with grayish epithelial scales; mucilaginous ....**Cydonium.**
Oblong-lanceolate, flat, thin, sharply two-edged, about 10 to 12 mm. long; whitish.......................**Cucumis.**
Subglobular, about 6 to 8 mm. in diameter; scarlet-red with black spot.................................**Abrus.**

SMALL SEEDS

Well-marked albumen

Angular, often adhering to one another; about 3 mm. long; brownish-yellow ....**Cardamomi Semen.**
Obovate or nearly globular, finely pitted, 1 to 2 mm. in diameter; reddish-brown ....**Colchici Semen.**
Kidney-shaped, flattened, pitted, about 3 mm. long; brownish-black ....**Stramonii Semen.**
Kidney-shaped, flattened, reticulately wrinkled, 1 to 1.5 mm. long; gray or yellowish-gray.................**Hyoscyami Semen.**
Very small seeds, about 0.75 mm. long, oblong, reticulated, brownish; acrid.........................**Lobeliæ Semen.**

Kidney-shaped, reticulately wrinkled, pitted, about 1 mm. long; yellowish-white........................**Papaveris Semen.**
Angular, obscurely tetrahedral, roughly nodulated or warty, about 1.5 to 2 mm. long; black...............**Delphinium.**
Globular, about 2 to 3 mm. in diameter, grayish or dirty white; peppery taste...........................**Piper Album.**

Little or no albumen; two cotyledons

Oblong-ovate, flattened, 4 to 5 mm. long; glossy brown..**Linum.**
Almost globular, finely pitted, with circular hilum; about 1 mm. in diameter; reddish-black..................**Sinapis Nigra.**
Almost globular, finely pitted, with circular hilum; about 1.5 to 2 mm. in diameter; yellowish................**Sinapis Alba.**
Almost globular, nearly smooth; about 2 to 2.5 mm. in diameter; bluish or brownish-black................**Rapæ Semen.**
Oblong, angular, almost cubical, with a projection on one side; about 3 to 4 mm. long and about 2 mm. broad; brownish ....**Fœnum Græcum.**

Myristica

N. *Nux Moschata*, Nutmeg.—**O.** The kernel of the seed of *Myristica fragrans; Myristicaceæ*. It is more correct to call this

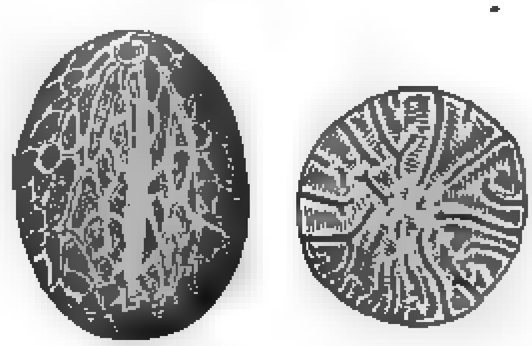


Fig. 414.

the kernel of the seed than to call it seed, because the external stony testa or seed-coat is removed before the drug is sent into trade.—**H.** India, Philippine, Molucca and Banda Islands, West Indies, South America; cultivated.—**D.** Fig. 414 shows whole nutmeg, and transverse section of same, both in natural size. Round or oval, 2 to 2.5 cm. long, externally brownish, reticulately wrinkled, sometimes with the depressions of these wrinkles filled with white lime dust, with a circular depression at apex and a whitish nipple-like projection at base, from which the depressed wrinkles radiate; internally fatty, pale yellowish-brown mar-

bled with dark brown markings due to folds or indentations of the inner seed-coat; consists mainly of albumen, with a small and often undeveloped embryo in a cavity near the base; odor fragrant, taste aromatic and somewhat bitter.—**C.** 2 to 4 per cent volatile oil, 25 to 35 per cent fixed oil, besides starch, etc.—**U.** A spicy and stimulant carminative and stomachic; mainly used merely as a flavor or spice. Dose: 0.5 to 1.5 grams.

Prime nutmeg should be about 2.5 cm. long, heavy, sound, and strongly fragrant.

Varieties: *Limed* or *Dutch nutmegs* are covered with a white powder, having been dipped into milk of lime, presumably to protect them against injury by insects.

Penang and *Singapore nutmegs* are darker-looking, not having been treated with lime.

A *false* or *wild* nutmeg is said sometimes to occur, but it may readily be distinguished from the genuine by its greater length and less thickness. The writer has seen it as a separate article of trade, but has never seen any mixed with the genuine.

Nux Vomica

N. *Nux vomica,* Quaker Buttons.—**O.** The seeds of *Strychnos Nux-vomica; Loganiaceæ.*—**H.** East India and East Indian Islands.—**D.** The illustrations show a whole seed, with exceptionally prominent rhaphe, and transverse and flat sections, all natural size. Orbicular, flat, disk-like seeds, up to 2.5 cm. in diameter, depressed near the middle and thickened about the margin, with a rather obscurely marked rhaphe running from the center of one side to the margin, beneath which latter point the radicle of the embryo is situated; grayish or greenish-gray with silky luster from minute soft hairs; the interior consists of a grayish-white, somewhat translucent, horny, exceedingly tough albumen with a large but very shallow central cavity into which the cotyledons of the embryo project; odor none, taste intensely and persistently bitter.—**C.** From 1.9 to 2.1 per cent alkaloids, of which one-half is strychnine, the other half being brucine, some fixed oil, etc.—**U.** In small doses a bitter tonic, in somewhat larger but still medicinal doses a motor excitant, useful in paralyses, especially when due to peripheral causes, from disuse of muscles, as in a fractured limb after the bandages are removed,

or when following diphtheria, etc.; in paralyses due to central or brain lesions, nux vomica or its preparations are of less benefit. Dose: 0.05 to 0.3 gram, in tincture, extract or fluid extract. The drug is most frequently administered in the form of strychnine, of which the dose is from 1 to 3 milligrams (0.001 to 0.003 gram).

Poisonous Effects: When given in excessive doses nux vomica (or strychnine) is a powerful poison, acting on the spinal cord and nerves and causing violent tetanoid contractions of the muscles. If death occurs it is due to asphyxia, owing to the inability of the patient to exhale, the muscles of respiration remaining fixedly contracted. Antidotal treatment consists in prompt evacuation of the stomach and the administration of chemical and physiological antidotes. The best chemical antidote is potas-

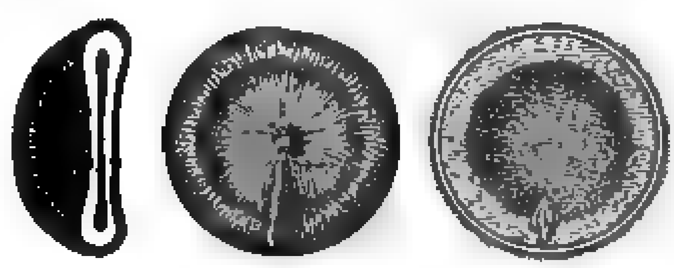


Fig. 415.

sium permanganate, the solution of which should be freely given; tannic acid has also been recommended. As physiological antidotes, ether, chloroform, bromide of potassium, amyl nitrite, etc., have been recommended. Violent depressants, such as tobacco, etc., are also physiological antidotes, but if used at all must be given with great caution.

Ignatia

N. Ignatia, St. Ignatius' Bean.—**O.** The seeds of *Strychnos Ignatii; Loganiaceæ.*—**H.** Philippine Islands.—**D.** Fig. 416 shows a whole seed, and longitudinal and transverse sections of same, all in natural size. The seeds are irregularly ovate and angular, 2.5 to 3 cm. long by about 2 cm. broad and 1.5 cm. thick, dull brownish-black, very hard, slightly translucent when fresh but becoming more opaque with age; hilum near one end along margin; the light-brownish albumen, which constitutes most of the

contents of the seed, has a large but shallow cavity into which the cotyledons of the embryo project; odor none, taste intensely and persistently bitter.—**C.** Same as in nux vomica, but both strychnine and brucine are present in greater proportion, 1 to 1.5 per

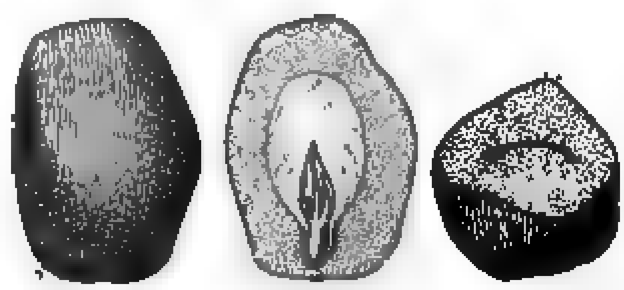


Fig. 416.

cent of each; also some fixed oil, etc.—**U.** Same as of nux vomica, but the dose is only about half as large; seldom used, except for the manufacture of strychnine.

Areca

N. Areca Nut, Betel Nut.—**O.** The seed of *Areca Catechu; Palmaceæ*.—**H.** India.—**D.** Fig. 417 shows a whole seed, *a*, and the base with hilum, etc., to the right in natural size; transverse section (middle drawing) somewhat enlarged. Areca nut consists mainly of albumen, the small embryo being imbedded within this just over the round spot on the base; the seed has the shape of a short, rounded cone, about 2.5 to 3 cm. long, with a flattened base having a depressed center; the outer coat is brownish,

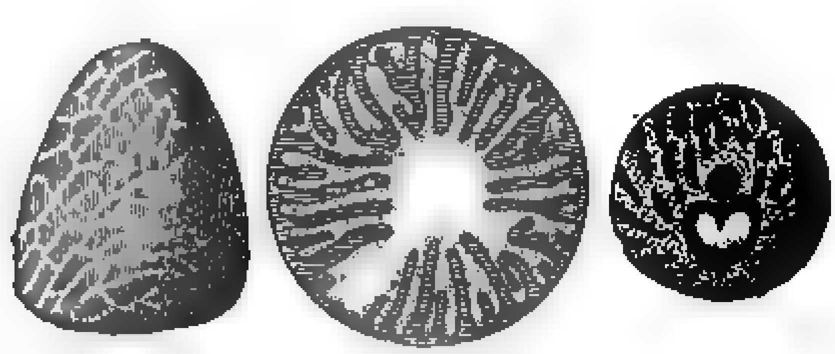


Fig. 417.

covered with a net-work of reddish veins which penetrate into the white albumen of the seed, giving a section an appearance somewhat like that of nutmeg; the seed is heavy, hard, dense, and difficult to cut or break; when freshly broken the fragments have

a cheese-like odor, taste astringent.—**C.** About 15 per cent tannin resembling that of catechu; about 14 per cent fixed oil, etc.; the seed also contains some constituent which renders the fluid extract liable to gelatinize.—**U.** Astringent and anthelmintic or tænicide; dose: 15 to 20 grams, best as fluid extract. In Oriental countries it is chewed, as tobacco is in our country; for that purpose it is mixed with the leaves of the Betel pepper and lime, and is known as *Betel.*

A charcoal made of areca nuts is used as a dentifrice.

Amygdala Amara

N. Bitter Almond.—**O.** The seeds of *Prunus Amygdalus (Amygdalus communis)*, var. *amara; Rosaceæ.*—**H.** Cultivated in Southern Europe.—**D.** Closely resemble sweet almonds in appearances, which see for description and illustrations. Bitter almonds average a little shorter and a little thicker than sweet almonds; taste bitter, with a flavor of peach kernels.—**C.** By expression bitter almonds yield from 30 to 50 per cent of a sweet, bland, fixed oil, identical with that obtained in the same manner from sweet almonds; between 20 and 30 per cent of a peculiar albumen which is called *emulsin*, and which is capable of emulsifying the oil in the seeds when the latter are triturated with water; also from 1 to 3 per cent of *amygdalin*, a substance which is peculiar to the bitter almonds and is not found in sweet almonds; by the reaction of *emulsin* on *amygdalin* in the presence of water, oil of bitter almond and hydrocyanic acid are produced.—**U.** Bitter almonds are only used for flavoring, the sedative effects of the hydrocyanic acid being more reliably obtained from dilute hydrocyanic acid properly diluted. Bitter almonds are poisonous in large doses.

Amygdala Dulcis

N. Sweet Almond.—**O.** The seeds of *Prunus Amygdalus dulcis (Amygdalus communis*, var. *dulcis); Rosaceæ.*—**H.** Cultivated in Southern Europe.—**D.** Fig. 418 shows an almond in the shell, a seed removed from the shell, and a transverse section of the latter; sweet almonds should be large, sound, clean, whole, and perfectly white within. The seeds are ovate or oblong-lanceolate,

flattish, about 2.5 cm. long, yellowish-brown covered with lines radiating from a scar at the thick end; the white and oily embryo consists of two plano-convex cotyledons with a short radicle at the pointed end, and usually a small plumule between the cotyledons; no odor, taste sweetish, bland, nut-like. **C.** Same as of bitter almonds except that they contain no *amygdalin*. An emulsion of sweet almond does not have the odor of hydrocyanic acid; any such odor would prove the admixture of bitter almonds.—**U.** Nutrient. By triturating with water an emulsion is obtained which is an agreeable vehicle for the administration of other remedies. This emulsion is preferably made from blanched almonds.

Blanched almonds are prepared by putting the almonds in lukewarm water for a short time, when the seed-coats swell and sepa-

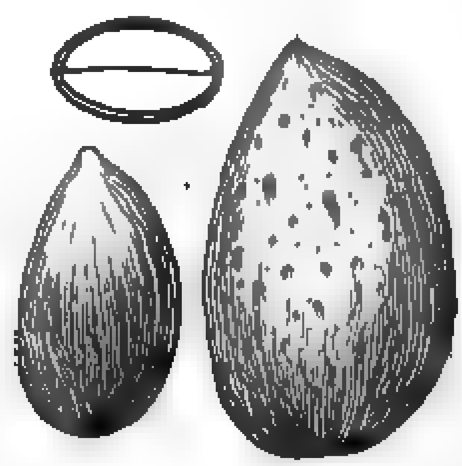


Fig. 418.

rate from the embryo, so that they can then be readily removed; hot water will separate the seed-coats more rapidly, but it may alter the emulsin, so that merely warm water should be preferred for blanching almonds.

Physostigma

N. Physostigma, Calabar Bean.—**O.** The seeds of *Physostigma venenosum; Leguminosæ*.—**H.** Western Africa, near the mouth of the river Niger.—**D.** Fig. 419 shows the whole bean and a transverse section, all in natural size. Oblong, kidney-shaped, about 2 to 3 cm. long, hard, externally smooth, glossy chocolate-brown or grayish-brown, with a broad and deep reddish-black groove, the hilum, along the convex edge; the embryo consists of two white concavo-convex cotyledons with a short radicle, so that the

seed is hollow within; odorless and nearly tasteless.—**C.** Physostigmine or eserine, calabarine, etc. It should yield not less than 0.15 per cent of alkaloids.—**U.** Motor depressant, sedative, in large doses poisonous; mainly used locally in eye-troubles, to contract pupil. Dose: 0.06 to 0.25 gram of the powder, or corresponding doses of the fluid extract or tincture; the dose of the solid extract is about 0.008 gram.

The antidotal treatment in cases of poisoning by calabar bean consists in evacuating and washing the stomach, and administering atropine in doses of about 0.001 gram.

Some years ago mention was made of a somewhat different variety which had been found as an admixture with this drug; it was called *Physostigma cylindrospermum* and was said to differ

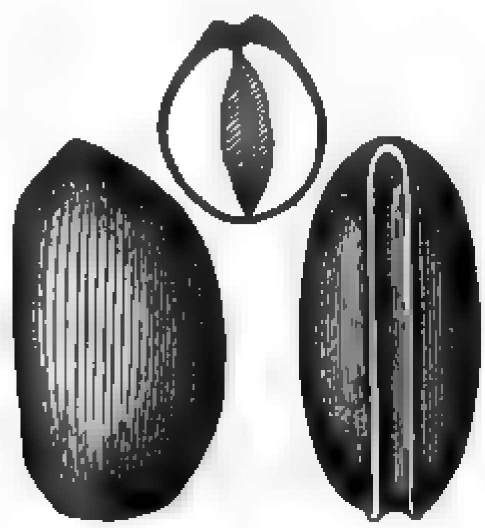


Fig. 419.

mainly in being considerably longer and having a shorter hilum. In some of the more recent works all mention of this admixture is omitted, so that it probably no longer occurs.

Theobroma

N. Cacao, Cocoa, Chocolate Bean.—**O.** The seeds of *Theobroma Cacao; Sterculiaceæ.* After gathering, the seeds are *cured* by a process of partial fermentation by being laid in heaps on the ground, covered with leaves during the night but exposed to the sun by day, or by being packed in barrels or buried in pits in the ground for a few days, after which they are spread out and dried. By this process the bitter taste of the fresh seeds is removed.—**H.** Tropical America; cultivated in all tropical countries.—**D.**

Fig. 420 shows the seeds; *a*, side; *b*, edge; *c*, outer and *d*, inner surfaces of cotyledons; *e*, tranverse section. Oval, compressed, about 2 to 2.5 cm. long, reddish-brown or grayish-brown, with numerous veins; hilum at the broad end, from which a line runs along the more convex border of the seed to the narrow end, where the chalaza is situated; shell thin and fragile, embryo reddish-brown, the two cotyledons irregularly ribbed, or ridged, brittle and oily;

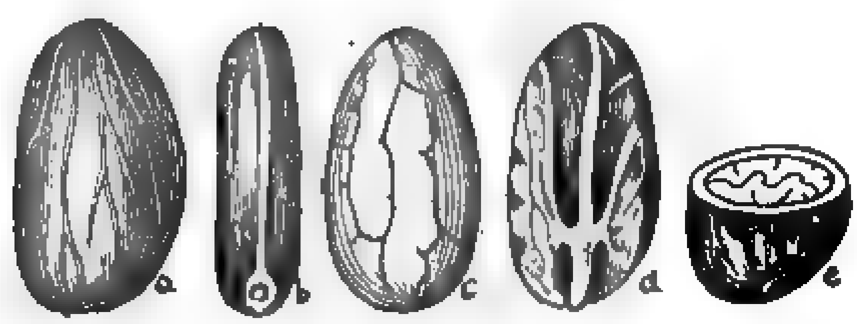


Fig. 420.

taste oily and aromatic.—**C.** About 1 to 1.5 per cent theobromin, about 50 per cent fixed oil (butter of cacao), starch, etc.—**U.** The whole seeds roasted and ground fine are used to make chocolate; the seeds deprived of most of the fixed oil and ground fine are used to make "cacao" or "cocoa," a drink similar to chocolate, but less rich and considered more digestible.

Dipterix

N. Tonka, Tonco, Tonka Bean. The word "tonco" or "tonka" is indeclinable and neuter.—**O.** The seeds of *Dipterix odorata* and *D. oppositifolia; Leguminosæ.*—**H.** Guiana, in Northeastern part of South America.—**D.** Fig. 421 shows a large seed of "Dutch Tonka," whole, and with a part of one cotyledon cut away to show radicle and plumule, both natural size. Oblong, somewhat compressed or flattened, 4 to 5 cm. long and up to 15 mm. broad; externally blackish-brown, wrinkled, sometimes covered with minute, white, acicular crystals of coumarin; internally pale-brown, oily; odor fragrant, taste aromatic bitter.—**C.** The pleasant aroma, which reminds of vanilla, is due to coumarin, a neutral principle which is soluble in fats, alcohol, diluted alcohol, but only slightly in water; tonka also contains about 25 per cent

fixed oil, sugar, mucilage, etc.—**U.** Mainly used for flavoring, as a cheap substitute for vanilla.

Dutch tonka beans (from *D. odorata*) are the best; they are

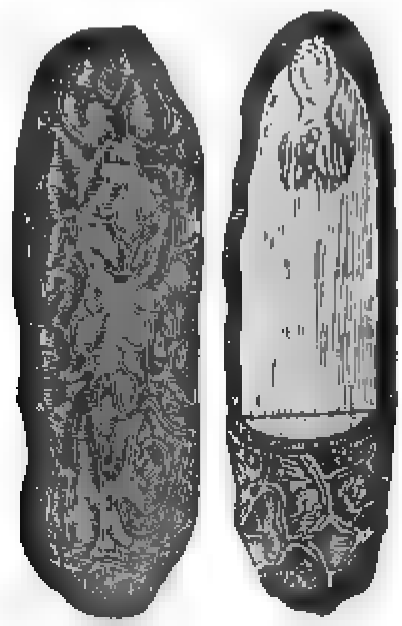


Fig. 421.

larger, plumper and more frequently covered with coumarin crystals than *English tonka beans* (from *D. oppositifolia).*

Citrullus

N. *Citrulli Semen,* Watermelon Seed.—**O.** The seeds of *Cucumis (Cucurbita) Citrullus; Cucurbitaceæ.*—**H.** Cultivated generally.—**D.** Fig. 422 shows seed whole, from side and edge, in transverse section, and embryo, all natural size. Ovate, flat, about 12 mm. long, blackish, blackish-brown or pale-brown with black edges; the embryo consists of two white plano-convex

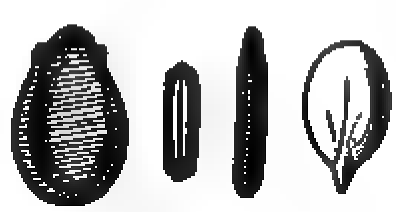


Fig. 422.

cotyledons and a small radicle; odorless, taste insipid.—**C.** No satisfactory analysis; about 30 per cent fixed oil, etc.—**U.** Diuretic, demulcent and anthelmintic. Dose, in infusion, practically *ad libitum.*

Pepo

N. *Peponis Semen,* Pumpkin Seed.—**O.** The seeds of *Cucurbita Pepo; Cucurbitaceæ.*—**H.** Cultivated.—**D.** Fig. 423 shows seed, transverse section of same, and embryo, all natural size. Oval or ovate, flat, about 12 to 20 mm. long, whitish; inodorous,

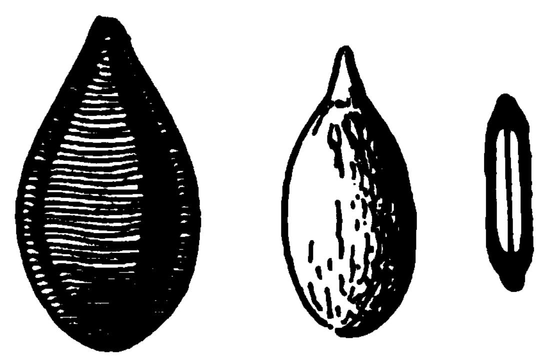


Fig. 423.

taste insipid.—**C.** About 30 to 40 per cent fixed oil, resin, proteids, starch, sugar, etc.—**U.** Tænifuge; best given by beating the embryos to a pulp with sugar and making an emulsion which is to be taken without straining; or the seeds may be eaten raw like nuts. Dose: 25 to 75 grams.

Strophanthus

N. Strophanthus Seed.—**O.** The seeds of *Strophanthus Kombe* and *S. hispidus; Apocynaceæ.*—**H.** Tropical Africa.—**D.** Fig. 424 shows a whole seed deprived of its awn, as it comes into the trade; also, the kernel consisting of a sac-like albumen which envelops the embryo, the embryo separate, and a transverse section of the seed, all natural size. The seeds grow in pods and

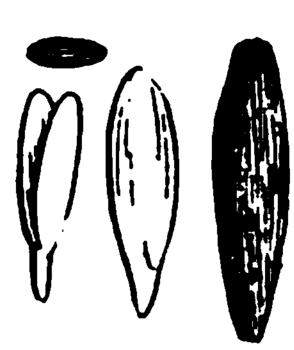


Fig. 424.

each seed is provided with an awn up to 10 cm. long with a tuft of delicate white silky hair covering its upper half; this awn and tuft of hairs is not present in the drug. The oblong-lanceolate seeds vary in length and are from 19 to 20 mm. long, 3 to 5 mm.

wide, and about 2 mm. thick, tapering towards both ends, usually flat, but sometimes rounded, brittle, easily broken, yellowish-brown with occasionally a greenish tint, and covered with appressed silky hairs; the white embryo consists of a radicle and two straight thin cotyledons and is enclosed in a white sac-like albumen; no odor, taste very bitter.—**C.** Strophanthin.—**U.** Used in Africa to make an arrow poison; in medicine, as a heart sedative; in overdoses it is a powerful poison, paralyzing the respiratory muscles as well as the heart. The dose is uncertain, but may be stated to be from 5 to 10 minims of a 5 per cent tincture.

The seeds of *Str. hispidus* and *Str. dichotomus* are more chestnut-brown and less hairy; the seeds of *Kicksia Africana* are pointed at both ends and the cotyledons are irregularly folded. If a thin section of the true *Kombe* seed is placed on a microscope slide and a drop of concentrated sulphuric acid is added, the albumen or endosperm (and if the seeds are rich in strophanthin, the embryo also) will be colored intensely green, which can be easily seen with a Coddington lens.

Caffea

N. *Caffeæ Fabæ, Coffeæ Semen,* Coffee.—**O.** The seeds of *Coffea Arabica; Rubiaceæ.*—**H.** Cultivated in most tropical and subtropical countries.—**D.** Fig. 425 shows the whole seeds or beans, face and back, in natural size, and a transverse section showing the infolding of the seed-coats, enlarged; also a more highly magnified section of the seed-coats. Coffee beans are plano-convex, oval, with a groove the entire length of the flat surface, 8 to 12 mm. long, greenish or bluish-brown; the bean consists mainly of a tough albumen, in one end (base) of which a small di-cotyledonous embryo is situated; odor peculiar, faint before roasting, taste bitter and astringent.—**C.** About 0.8 to 1 per cent caffeine, caffeo-tannic acid, etc.—**U.** Tonic and stimulant. Infusion of coffee is used as a daily drink by a large portion of the human race; it moderates waste, improves digestion, produces mental exhilaration and physical activity. No dose of this drug can be stated as it is habitually used in widely varying quantities by different persons. In opium poisoning

large quantities of strong infusion of coffee should be given.

Mocha Coffee, grown in Arabia, consists of very small beans of a dark color, very plump. It has a fine flavor and is much esteemed, and is often added to other kinds of coffee to improve the flavor of the infusion.

Rio Coffee (South American or Rio Janeiro) is also comparatively small and dark-colored, but not so plump as Mocha, and has, when prepared for use, a stronger and less delicate flavor than other kinds of coffee.

Java Coffee, with large, flattish, light-colored beans, has a fine, delicate flavor.

Liberia (African) *Coffee,* which has the largest seeds of all, is also light-colored and has a fine flavor.

These different varieties are seldom employed separately, but are usually mixed in various proportions by the experts of the

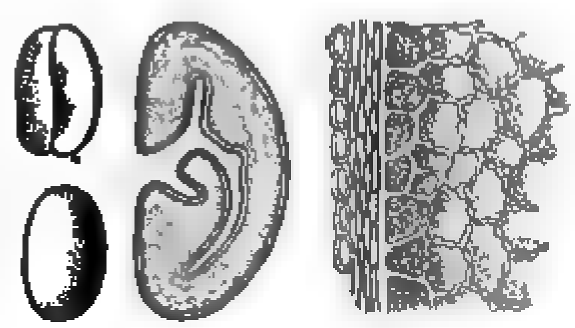


Fig. 425.

large coffee houses, to produce the so-called "blends" which are generally preferable to any one kind alone. For use, coffee must be *roasted* or *parched;* this should be done as rapidly as possible without burning the coffee, until the seeds are fully brown but not black. The peculiar aroma is produced by this parching, so that if coffee is insufficiently parched it will produce a disagreeable, insipid and somewhat bitter infusion, while if it is parched too much, it acquires an empyreumatic and bitter flavor.

Staphisagria

N. Stavesacre.—**O.** The seeds of *Delphinium Staphisagria; Ranunculaceæ.*—**H.** Mediterranean countries.—**D.** Fig. 426 shows a seed in natural size and enlarged. Irregularly tetrahedral, flattish, angular, 5 to 7 mm. long, externally brownish or brownish-

gray, with reticulate ridges; the whitish oily albumen contains a small embryo at one end; odor slight, taste bitter and acrid.—**C.** Delphinine (delphisine), delphinoidine, staphisain, fixed oil, etc.—

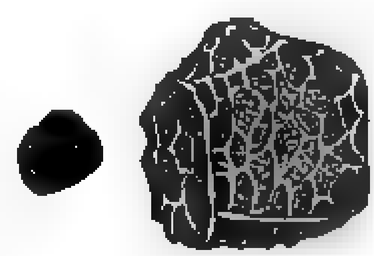


Fig. 426.

U. Staphisagria is said to possess diuretic, cathartic and emetic properties. Its principle use is local, to destroy parasites and vermin.

Sabadilla

N. Cevadilla.—**O.** The ripe seeds of *Schœnocaulon officinale (Asagræa officinalis); Liliaceæ.*—**H.** Mexico and Central America.—**D.** Fig. 427 shows a capsule and seed of cevadilla in natural size and a capsule and transverse section of same, and a seed and longitudinal section of same, enlarged. The drug consists of opened and unopened capsules or follicles mixed with the loose seeds, but when wanted for use the follicles should be rejected. The thin brown follicles adhere to each other at the base and each

Fig. 427.

contains from 1 to 6 seeds; the seeds are lanceolate, angular, about 6 mm. long, 1.5 to 2 mm. thick at the thickest end, glossy brownish-black, with thin and finely wrinkled seed-coat; the white oily albumen contains a small embryo near the base; the

seeds, which alone contain the active constituents, are inodorous, but have an acrid, persistent, bitter taste.—**C.** The alkaloids veratrine, cevadine, cevadilline, etc.—**U.** The seeds are poisonous. The action depends on the veratrine which they contain. Mainly used for the manufacture of veratrine and externally in ointment as a parasiticide to destroy lice and other vermin, and as a cure for itch.

When taken internally it is a powerful irritant depressant; its dose should not exceed 0.05 to 0.1 gram, but its value as a remedial agent is doubtful and the possibility of untoward results so great that it is better to choose other remedies. In case of poisoning, the antidotal treatment consists in evacuating and washing the stomach, giving tannic acid and stimulants, such as coffee, alcohol, etc., and applying warmth externally.

Cydonium

N. Quince Seed.—**O.** The seeds of *Cydonia vulgaris (Pyrus Cydonia); Rosaceæ.*—**H.** Cultivated.—**D.** The seeds resemble apple seeds, but in the fruit they are agglutinated as represented in Fig. 428, *b*, and they often remain so in the drug; *a* shows a seed in natural size, *c* the same enlarged, and *d* a section of the seed-coats showing the outer epidermal cells which con-

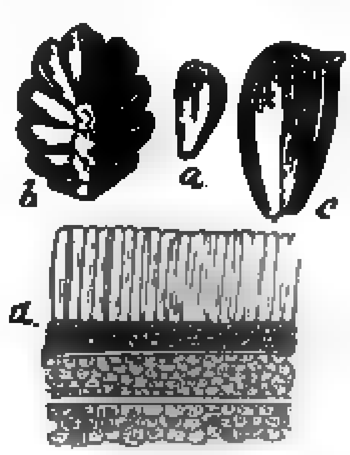


Fig. 428.

tain the mucilage. The seeds are ovate or ovate-oblong, triangularly compressed, about 8 mm. long, grayish-brown; the white embryo consists of two cotyledons and a radicle; the whole seeds are odorless, but when chewed the embryo develops the odor and taste of bitter almonds.—**C.** The only important constitutent is the mucilage in the epithelium of the seed-coats;

...ed in water they swell, forming an
...—U. The mucilage is used as a demul-
...ions, for similar purposes as the mu-
...acacia. It must be freshly made

... whole, sound and odorless; they
...le or pear seeds in the drug, but
...e recognized by their smooth oval
... and by the fact that they do not
...e seeds are covered with a grayish
...h look as if they were slightly

Cucumis

...mber Seed.—O. The seeds of *Cucu-*
H. Cultivated everywhere.—**D.** Fig.
... sections, all natural size; in struc-
... seed. Oblong-lanceolate, flat, thin,

...g. 429.

... 12 mm. long, whitish; inodorous
...eids, etc.—**U.** Cucumber seed is
... action, diuretic, demulcent and
... grams in infusion. An emollient
... cucumber seeds (or cucumber) in

Abrus

... Seeds.—**O.** The seed of *Abrus pre-*
... India.—**D.** Fig. 430 shows a
... of same, and an embryo, all in
... about 6 to 8 mm. long, very hard,
... spot at the hilum; embryo con-
...sions and a short curved radicle;

no odor, taste insipid.—**C.** Abric acid, fixed oil, 2 proteids which are similar in action to snake venom although much weaker,

Fig 430.

fixed oil, etc.—**U.** A weak infusion is sometimes used as a stimulating irritant in chronic conjunctivitis or granular eye-lids.

Cardamomi Semen

N. Cardamom Seed.—**O.** The seeds of *Elettaria Cardamomum; Zingiberaceæ.*—**H.** Malabar, India; see also description of car-

Fig. 431.

damom in Group LXII.—**D.** The seeds in each cell of the capsule of cardamom are mutually compressed into irregular angular shapes and adhere more or less firmly together, often remaining so in the drug; Fig. 431 shows the seeds, adhering as in the capsules and separated, in natural size and enlarged, and also longitudinal and transverse sections enlarged, showing the embryo in the large albumen. The seeds are irregularly angular, about 3 mm. long, with a grooved hilum, externally brownish-yellow, deeply wrinkled and with furfuraceous shreds of arillus adhering; odor fragrant, taste pungently spicy and aromatic.—**C.** Four to five per cent volatile oil, some fixed oil, etc.—**U.** Stimulant carminative and stomachic, but used mainly as a flavor or spice.

The seeds of other varieties of cardamom, such as Madras, Ceylon, Java or round, etc., resemble those described above in

appearance, but are less aromatic. On account of the difficulty of determining the absence of a possible admixture of these inferior seeds, it is best to buy the whole cardamoms and shell them oneself.

Colchici Semen

N. Colchicum Seed.—**O.** The seeds of *Colchicum autumnale; Liliaceæ.*—**H.** Europe.—**D.** Fig. 432 shows whole seed, natural

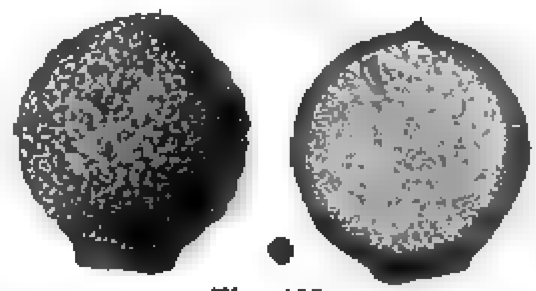


Fig. 432.

size and enlarged, and section, also enlarged. Subglobular, about 2 to 3 mm. in diameter, finely pitted, reddish-brown; seed consists mainly of albumen, enclosing a small embryo; very hard and tough; no odor, taste bitter acrid.—**C.** Four-tenths of one per cent colchicine, 6 to 8 per cent fixed oil, etc.—**U.** Cathartic and diuretic, mainly used as an arthritic in gout and rheumatism. The seeds are about double the strength of the tubers. Dose: 0.05 to 0.3 gram.

Stramonii Semen

N. Stramonium Seed.—**O.** The seeds of *Datura Stramonium; Solanaceæ.*—**H.** America, Europe, Asia; common weed nearly

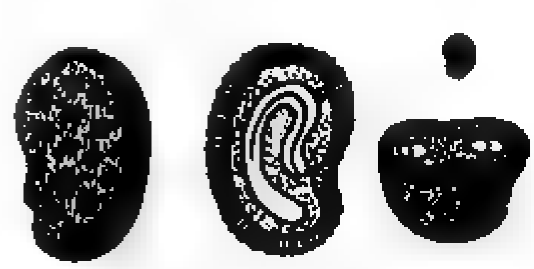


Fig. 433.

everywhere **D.** Fig. 433 shows the seed, whole in natural size and enlarged, and longitudinal and transverse sections, both enlarged. Kidney-shaped, flattened, about 3 mm. long, pitted

and wrinkled, hard, brownish-black to almost black; a large whitish and oily albumen contains the curved embryo, as shown in the sections of the seed; inodorous, bitter.—**C.** About 0.1 per cent daturine, about 25 per cent fixed oil, etc. Daturine is really a mixture of atropine and hyoscyamine.—**U.** Anodyne, narcotic and hypnotic. Dose: 0.05 to 0.2 gram.

Poisonous in overdoses. *Antidotal* treatment; evacuation and washing of stomach, stimulants such as coffee, alcoholic liquors, alternately hot and cold douches, etc.

Hyoscyami Semen

N. Henbane seed.—**O.** The seeds of *Hyoscyamus niger; Solanaceæ.*—**H.** Europe and Asia; naturalized in North America.—**D.** The drawings in Fig. 434 show a whole seed, natural size, a

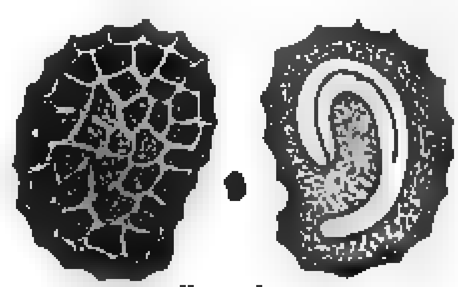


Fig. 434.

seed and a longitudinal section of one, both much enlarged. Flattish, roundish or slightly kidney-shaped, 1 to 1.5 mm. long, reticulately wrinkled, gray or yellowish-gray; internally whitish; the curved embryo is enclosed in an oily albumen; no odor, taste oily and bitter acrid.—**C.** Two alkaloids, hyoscyamine and hyoscine, a glucoside, about 25 per cent fixed oil, etc.—**U.** Same as of the leaves, but from 4 to 10 times as active. Anodyne, narcotic and hypnotic. Poisonous in large doses; antidotal treatment same as for stramonium seeds. Dose: 0.1 to 0.2 gram.

Lobeliæ Semen

N. Lobelia Seed.—**O.** The seeds of *Lobelia inflata; Lobeliaceæ.*—**H.** North America.—**D.** The figures show a whole seed and a seed in longitudinal section, enlarged about 35 diameters. In bulk the drug looks like a reddish-brown to dark-brown powder, but with a Coddington lens the appearance of the individual seeds is read-

ily discerned. The seed is very small, oblong or elliptic, about 0.75 mm. long and 0.3 mm. broad, reticulated, the longitudinal ridges being united by rather regular transverse ridges, giving the seed the appearance as if enclosed in a delicate basket or wicker-work; the di-cotyledonous embryo imbedded in a copious albumen; no odor, taste acrid.—**C.** Lobeline, lobelic acid, 30 per

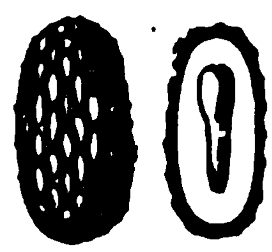


Fig. 435.

cent fixed oil, etc.—**U.** Same as of lobelia; sialagogue, expectorant, emetic, narcotic and purgative; in large doses powerfully depressant. Dose: 0.05 to 0.5 gram.

Papaveris Semen

N. Poppy Seed, Maw Seed.—**O.** The seeds of the white variety of *Papaver somniferum; Papaveraceæ.*—**H.** Asia Minor and India; cultivated.—**D.** The illustrations show seeds in natural size and one seed, whole and longitudinal section, much enlarged. Poppy seeds are kidney-shaped, about 1 mm. long, pitted, cream-colored or whitish; the white, oily albumen contains the slightly curved embryo; no odor, taste nutty oily.—**C.** About 50 per cent of fixed oil, very slight traces of morphine, etc.—**U.** As food, mainly; used

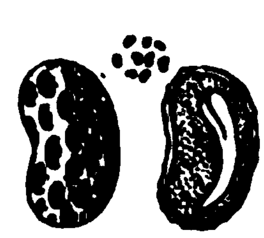


Fig. 436.

by bakers, sprinkled so that they become imbedded in the dough of rolls, "French bread," etc. As a demulcent in emulsion. Dose: 2 to 5 grams.

Delphinium

N. Larkspur Seed.—**O.** The seeds of *Delphinium Consolida; Ranunculaceæ.*—**H.** Europe; cultivated.—**D.** The illustrations

show a whole seed, natural size and enlarged, and a longitudinal section, enlarged. Small, obscurely tetrahedral, about 1.5 to 2 mm. long, externally rough-warty, blackish; internally whitish, the oily albumen enclosing a small embryo; no odor, taste bitter acrid.—**C.** An alkaloid, delphinine, some fixed oil, resin, etc.—

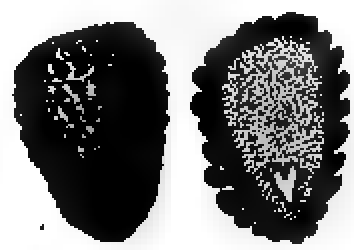


Fig. 437.

U. Antispasmodic in asthma; diuretic, cathartic, in large doses emetico-cathartic and poisonous; externally rubefacient. Dose: 0.06 to 0.2 gram.

Piper Album

White Pepper, while really more than a seed because the outer portion merely of the pericarp was removed, so that the pulp and fibro-vascular bundles of the pericarp still enclose the seed proper, yet looks so much like a seed that it will probably be looked for here by many. It is therefore mentioned in the synopsis of the group, but it has been fully described and figured in Group LXV.

Linum

N. Linseed, Flax Seed.—**O.** The seed of *Linum usitatissimum; Linaceæ.*—**H.** Cultivated in most temperate countries.—**D.** Fig.

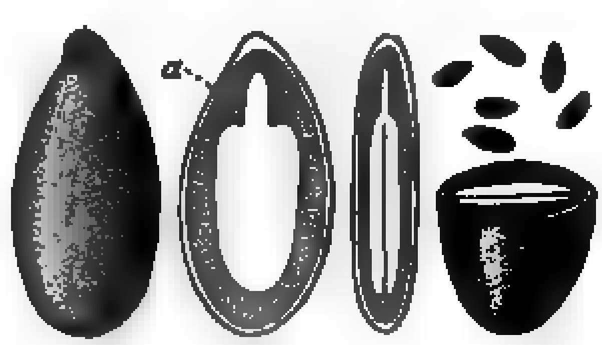


Fig. 438.

438 shows the seeds in natural size and enlarged, and also in longitudinal and transverse sections, enlarged. The seeds are

ovate, obliquely pointed at one end, flattened, about 4 to 5 mm. long, externally glossy brown, internally yellowish-white; the large embryo consists of two cotyledons and a radicle, surrounded by a thin, almost membranous albumen that is more likely to be considered as one of the seed-coats than as albumen; no odor, taste mucilaginous, oily and disagreeable.—**C.** About 15 per cent mucilage in the epithelium, from 30 to 40 per cent fixed oil in the inner portion (embryo and albumen) of the seed, proteids, some resin, etc.—**U.** The ground or crushed seeds are used for poultices; an infusion is sometimes made of the *whole* seeds. Demulcent. Dose: *Ad libitum,* as infusion.

Sinapis Nigra

N. Black Mustard.—**O.** The seeds *(Brassica) Sinapis nigra; Cruciferæ.*—**H.** Cultivated.—**D.** Fig. 439 shows a seed enlarged,

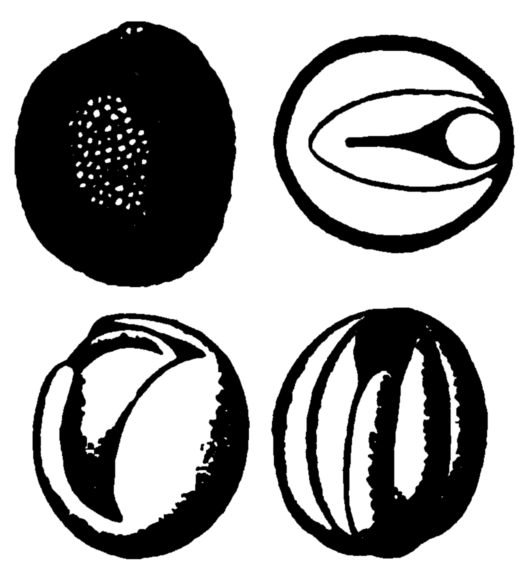


Fig. 439.

with its circular hilum; also a transverse section and two views of the embryo, showing one cotyledon wrapped about the other. Almost globular, about 1 mm. in diameter, with circular hilum, externally reddish-black and finely pitted, internally oily and greenish-yellow; no odor when dry, but on moistening it develops an extremely pungent and irritating odor; taste pungently acrid, aromatic.—**C.** About 25 per cent fixed oil; sinigrin or potassium myronate, myrosin, mucilage, etc.; little or no starch. When moistened, black mustard emits a strong irritant odor due to the volatile oil of mustard formed from the sinigrin by the action of myrosin in the presence of water.—**U.** Aromatic stimulant when eaten; in large doses (10 to 15 grams mixed with copious draughts of water) ground mustard is a prompt and efficacious

emetic; especially indicated in cases of poisoning because usually at hand everywhere. Externally a poultice made of ground mustard and luke-warm (not hot) water is a valuable rubefacient and counter irritant. Its main use is as a condiment.

Sinapis Alba

N. White Mustard.—**O.** The seeds of *Sinapis (Brassica) alba; Cruciferæ.*—**H.** Cultivated.—**D.** Fig. 440 shows a seed in natural size and enlarged; the embryo is like that of black mustard, only larger and with a somewhat larger radicle proportionately; in many of the seeds the seed-coats appear as if tightly stretched around the embryo so that the shape of the latter gives shape to the seed. Oval, almost globular, slightly compressed, about 1.5 to 2 mm. long, finely pitted or almost smooth, with a small hilum at one end and a more or less distinctly marked ridge over the radicle the full length of the seed, pale yellowish to yellowish-brown externally and yellowish within; inodorous when dry, but

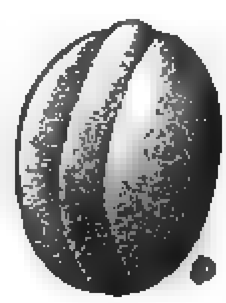


Fig. 440.

with strong characteristic odor when moistened; the taste is pungently aromatic, similar to that of black mustard, but weaker.—**C.** Like those of black mustard.—**U.** Mainly as a condiment and spice.

Semen Rapæ

N. Rape Seed.—**O.** The seeds of *Brassica Napus; Cruciferæ.*—**H.** Cultivated.—**D.** The shape of rape seed is like that of white mustard seed, the ridge over the curved radicle usually being very distinct. "German" rape seed averages about 1.5 mm. in diameter and is nearly smooth, though not glossy, and varies in color from deep red to nearly black. "English" rape seed is similar in shape, a trifle larger than the German, and of more uniform color, red-

dish-black; the embryo is formed like that of black mustard. Odor, taste and constituents similar to those of mustard.—**U.** Used as one ingredient of "mixed bird seeds."

Fœnum Græcum

N. Fenugreek.—**O.** The seeds of *Trigonella Fœnum Græcum; Leguminosæ.*—**H.** India; cultivated in Mediterranean countries.—**D.** Fig. 441 shows the whole seed, in natural size and enlarged; also transverse and longitudinal sections, enlarged. Almost cubical, or oblong quadrangular, four-edged, about 3 to 4 mm. long and about 2 mm. broad, hard, with a projection on one side reaching from one end to a little more than half-way along the side of the seed; yellowish-brown to brownish; the embryo consists of two cotyledons, and a large radicle which is contained in the projection on one side, and a horny albumen which is small in amount

Fig. 441.

and considered by some to be seed-coat and not albumen at all; peculiar odor and bitter mucilaginous taste.—**C.** The important ingredients are fixed oil and mucilage.—**U.** Powdered fenugreek is sometimes used to make emollient poultices, but is mainly employed in veterinary practice as a demulcent; it is a common ingredient of "condition powders."

GROUP LXVII

Cotyledons or Seed-Leaves

The embryos of di-cotyledonous seeds without albumen consist of two cotyledons or seed-leaves united at the base, and with a rudimentary nipple-like projection at one end, the root or ***radicle;*** sometimes there may be found between the two seed-leaves a rudimentary leafy branch, the *plumule.* When seeds are opened and their seed-leaves are prepared for the trade by removing the seed-

coats, they belong in this group; they are then occasionally called "*semina decorticata.*" Within the last few years kola, a drug, one variety of which consists of the cotyledons of a poly-cotyledonous seed, has also occurred in the trade.

Ovate, fleshy, plano-convex cotyledons, about 2.5 to 3 cm. long and half as broad; yellowish .... **Quercus Semen.**
Elongated, fleshy, plano-convex cotyledons, up to 4 cm. long; brownish-black .... **Pichurim majus.**
Similar to last, but only about 2 cm. long, ovate; brownish-black .... **Pichurim minus.**
Round, flattish-ovate, plano-convex, or irregular, somewhat contorted cotyledons; brownish or reddish-brown...... **Cola.**

Quercus Semen

N. *Glandes Quercus,* Acorns.—**O.** The separated cotyledons of the seeds of *Quercus Robur* and *Q. Sessiliflora; Cupuliferæ.*—**H.**

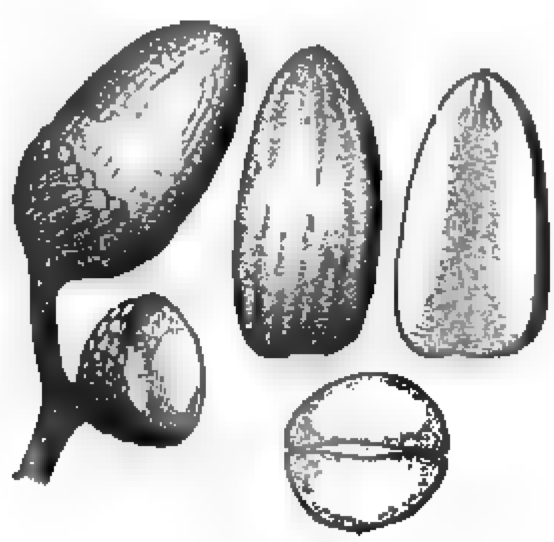


Fig. 442.

Europe.—**D.** Fig. 442 shows the whole fruit of *Q. Robur,* and the cotyledons, outer and inner surfaces and transverse section, all natural size. Only the cotyledons occur in the trade; they are thick plano-convex, oblong or ovate, about 3 cm. long and 1½ cm. broad, yellowish to yellowish-brown; no odor, taste bitter and astringent.—**C.** About 9 per cent tannic acid, bitter extractive, resin, oil, starch, etc.—**N.** The drug is roasted or parched like coffee, and is used as a substitute for coffee, especially when the latter is contra-indicated in nervous affections.

Glandes Quercus are quoted whole in the price lists of European

dealers in drugs but are probably seldom imported into this country otherwise than roasted and ground. They are seldom used in this country, parched rye being more commonly used as a substitute for coffee. The parched and ground drug is commonly known as "*glandulæ quercus tostæ.*"

Pichurim

N. *Pichury, Semen Pichurim, Fabæ Pichurim,* Pichurim Beans, Sassafras Nuts.—**O.** The cotyledons of the seeds of *Nectandra Puchury-major* and *N. Puchury-minor; Lauraceæ.*—**H.** Venezuela, Brazil, and other parts of South America.—**D.** There are two varieties of Pichurim beans, which are the product of the same

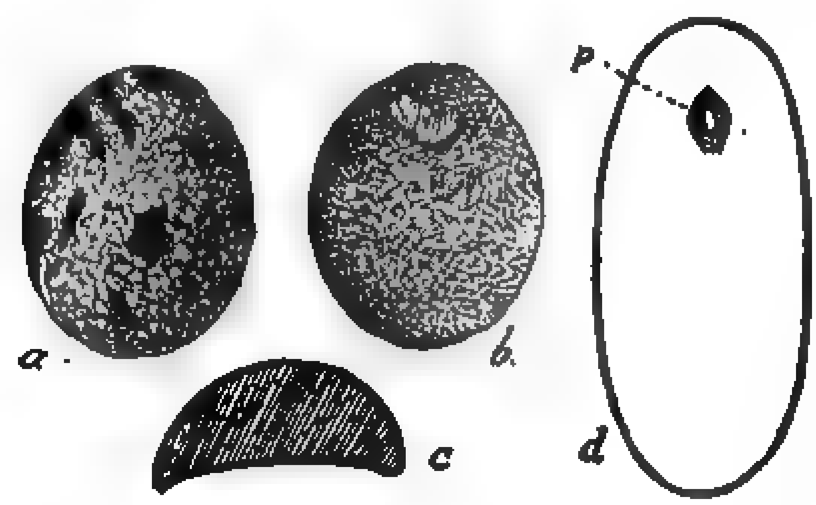


Fig. 443.

variety of tree, the difference in size being due probably to differences in soil or climate or both, the "*fabæ pichurim majores*" and "*fabæ pichurim minores,*" or *larger* and *smaller* pichurim beans; Fig. 443 gives a good idea of shape and size, *a* showing the outer and *b* the inner surfaces of a cotyledon of the smaller kind, *c* a transverse section of the same, and *d* the outline of a cotyledon of the larger kind showing position of plumule; blackish-brown externally, lighter-colored internally; odor and taste aromatic, reminding of nutmeg and saffron.—**C.** 2 to 3 per cent volatile oil, about 30 per cent fixed oil or fat, resin, coloring matter, etc.—**U.** In South America they are used like we use nutmegs, as a condiment or spice; also as a stimulant aromatic in cases of bowel affections, diarrhœa, dysentery, etc. Seldom used in this country. Dose: 0.5 to 1.5 grams, in powder.

Cola

N. ***Kola, Nuces Cola, Semen Cola,*** Cola, or Kola Nuts, Guru Nuts. The Guinea name ***Kola*** or ***Cola*** is indeclinable and neuter in Latin.—**O.** The cotyledons of several varieties of Cola, ***Sterculia (Cola) acuminata*** and ***St. vera; Sterculiaceæ.***—**H.** Native of Africa, but cultivated in tropical countries.—**D.** The seeds of ***Sterculia vera*** have two roundish, rather flattish, plano-convex cotyledons, the inner surface of one of which is figured in the smaller drawing; the seeds of ***St. acuminata*** have four cotyledons, which, when separated and dried as in the drug, are irregularly contorted or twisted, as shown in the larger figures; all the figures are of natural size; when fresh, both varieties are car-

Fig. 444.

mine-red, but in the drug the color is brown to brownish-black, some pieces occasionally showing reddish, liver-colored or yellowish-brown patches; both kinds are very hard, and without odor or taste.—**C.** A glucoside, kolanin, which decomposes readily into caffeine, glucose and kola-red. The drug contains from 0.75 to 2 per cent of caffeine, some tannin, etc.—**U.** Similar to that of coffee, tea, guarana, etc. Dose: About 10 grams during the day.

GROUP LXVIII

Arilli or Adventitious Seed-Coats

In the general remarks on seeds we studied the structure of seeds and learned that the two ovule-coats develop into seed-coats. Sometimes, in addition to these coats which fit snugly

around the embryo or albumen, and which are usually closely adherent, although not always united, there may be adventitious growths of cell-proliferations from the funiculus, more rarely from the placenta, which form another, apparently a third, or adventitious seed-coat, but this coat rarely fits closely, but is easily separable. Such an adventitious seed-coat is called an *arillus* or *aril*.

Fleshy, irregularly lobed and cleft bands, orange-brown; fragrant....**Macis**

Macis

N. Mace.—**O.** The arillus of *Myristica fragrans; Myristicaceæ*.—**H.** India, Philippines, Molucca and Banda Islands, West Indies,

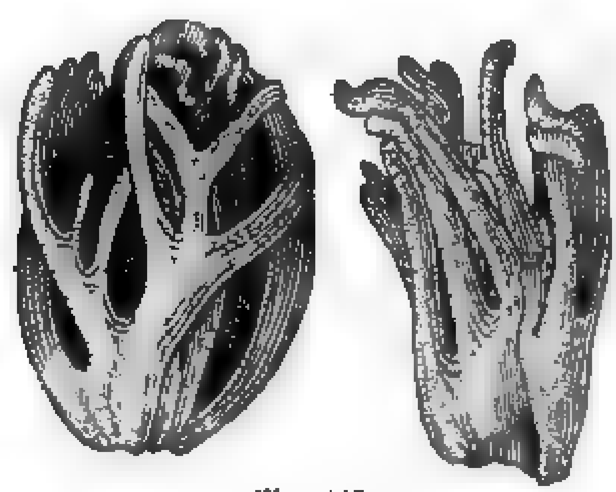


Fig. 445.

South America; cultivated.—**D.** The fruit of this tree resembles a small peach in appearance; the fleshy outer portion becomes dry and coriaceous when ripe and separates into two valves, exposing to view a scarlet-red membranous arillus which surrounds the kernel or seed; the kernel, which is the nutmeg, is enclosed in a thin, glossy, brown shell, and the latter is surrounded by the arillus just mentioned. Fig. 445 shows a seed enclosed by the arillus, and, to the right, the arillus separated as it occurs in the trade, both in natural size. The arillus separated from the seed and dried, becomes flattened as in Fig. 445; it is multi-cleft almost to the base, into a number of lobes and each lobe in turn is more or less irregularly cleft into flattish, broad or narrow, wavy or contorted bands; Fig. 446 shows an unbroken piece of mace

spread out after having been softened by soaking in water, in natural size; orange-brown, somewhat brittle and often broken; odor and taste fragrant, aromatic.—C. 7 to 9 per cent vola-

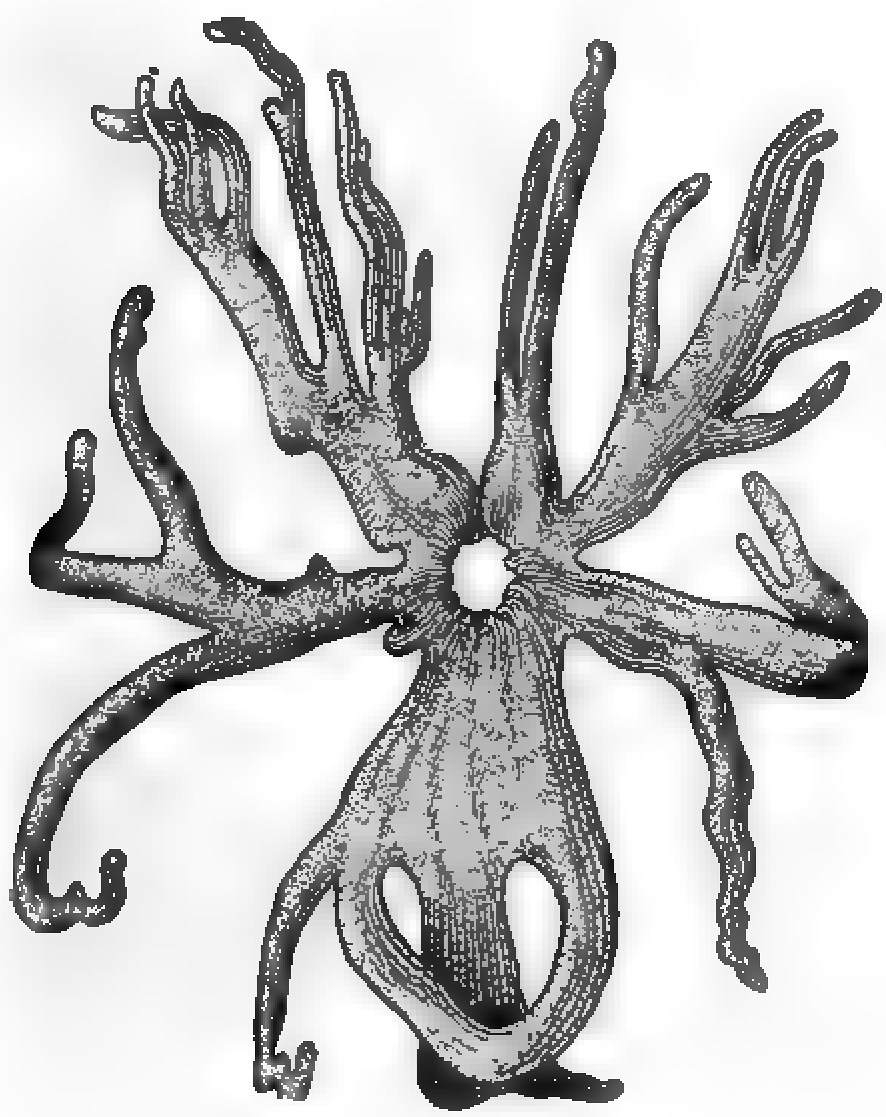


Fig. 446.

tile oil, fixed oil, some resin, etc.—U. As a condiment or spice; stimulant, carminative. Dose: 0.5 to 1.5 grams.

PARTS OF PLANTS NOT EASILY RECOGNIZABLE AS SUCH

We come now to the last general group of vegetable drugs showing organic or cell structure, which we divide as follows:

Parts of plants not easily recognizable as such	Whole LXIX
	Cut, or otherwise altered.......LXX
	Trichomes LXXI
	Excrescences LXXII

These groups contain a heterogeneous collection of drugs which have no relations to one another, except that it may be difficult for some to make out just what they are, or from what part of a plant they are derived. Some may perhaps think that drugs are enumerated here that should not be included; for instance, many would easily recognize cloves as an unopened flower, while others, not as good botanists, might be puzzled to place them in their proper group. But it is thought better to include too many rather than too few drugs here, and therefore, as far as possible, all drugs that may prove difficult for someone are placed in one of these groups. It is better to make things too plain and simple, than to fail to give the information sought.

In Group LXIX are included a few drugs which are "cut or otherwise altered," which would make them belong in Group LXX, as for instance, squill, saffron, pearled barley, spunk, etc.; but some may not notice that these were cut, because superficial inspection does not always make this unmistakably clear. Therefore such drugs are included in both groups.

Many of the trichomes, or epidermal appendages or outgrowths, such as glands or hairs, are whole, but they are not included in Group LXIX, because even a careless examiner will probably place them in Group LXXI, even if it is impossible from such a careless examination to determine exactly what any one particular drug of the group may be.

Drugs are described in the groups in which they properly belong, but many are enumerated in such groups where beginners, students, or unskillful and inexperienced pharmacognosists may erroneously suppose that they should be found. These notes are intended to enable a student to recognize drugs; scientifically and systematically, if possible, but if necessary, "any old way," just so he learns to recognize drugs.

GROUP LXIX

Parts of Plants, Not Easily Recognizable as Such; Whole

The numbers after the names of the drugs refer to the pages on which they are described.

Filiform, much-branched, horny, translucent thallus....**Chondrus**, 117.
Dark-brown or nearly black thallus with large air-vesicles ....**Fucus**, 119.
Long, round, stem-like, but without nodes and without cell-differentiation within ....**Laminaria**, 120.
Mixture of several small sea-weeds....................**Corsican Moss**, 120.
Irregularly lobed lichens, brownish-gray above and grayish-white below ....**Cetraria**, 121.
Flat, brown lichen, with oval prominences on one side and corresponding depressions on the other side....**Sticta**, 122.
Fusiform, purplish-black grains, from 2 to 5 cm. long....**Ergota**, 123.
Irregular brown-black masses, partly membranaceous, partly pulverulent ....**Ustilago**, 125.
White, tough, light masses or fragments...............**Agaricus**, 126.
Ovate, fleshy, plano-convex cotyledons, about 2.5 to 3 cm. long and half as broad; yellowish............**Acorns**, 495.
Elongated or ovate, fleshy, plano-convex cotyledons, from 2 to 4 cm. long; brownish-black..............**Pichurim**, 496.
Fleshy, irregularly lobed and cleft bands, orange-brown; fragrant ....**Mace**, 498.
Round, hard, more or less nodulated, about 2 cm. in diameter; dark-colored ....**Galls**, 511.
Irregularly lobed, hollow, thin-walled shells............**Chinese Galls**, 512.
Round, spongy, orange or yellowish-brown, up to 5 cm. or more in diameter..............................**American Galls**, 512.
Brown, pliable, velvety sheets........................**Spunk**, 126.
Semi-fluid, viscid, frothy substance...................**Yeast**, 126.
Round, dark-brown masses, pulverulent within..........**Puff-Ball**, 127.
Light-yellow, very mobile and inflammable powder.....**Lycopodium**, 128.
Flattish rhizomes, lobed, peeled, brownish, yellowish, or white from being limed.........................**Zingiber**, 241.
Narrow slices, up to 5 cm. long and 10 to 15 mm. wide; thickest in middle; yellowish-white...............**Scilla**, 262.
Slender cylindrical, sometimes curved pieces, spongy, white ....**Sassafras**, 273.
Similar to last, but thicker and yellowish in color.......**Elder Pith**, 273.
Elongated, somewhat angular, scaly, unopened flower-heads, 2 to 3 mm. long; grayish-green..............**Santonica**, 386.
Sub-cylindrical calyx-tube with four teeth, terminated by a corolla forming a globular head; brown; fragrant ....**Caryophyllus**, 392.
Separate stigmas, or 3 attached to a style, linear-tubular, about 3 cm. long; deep reddish-brown..............**Crocus**, 405.
Cylindrical, about 4 to 5 cm. long and 5 mm. thick, spirally nodulated, stalked, grayish-brown.........**Piper Longum**, 420.

Oval or round grains, 2 to 4 mm. long, yellowish-white, whiter at ends, yellowish-brown groove along one side .... **Pearled Barley**, 466.

GROUP LXX

PARTS OF PLANTS NOT READILY RECOGNIZABLE AS SUCH; CUT OR OTHERWISE ALTERED

This group includes drugs which are sliced, trimmed, peeled, or cut up into small pieces; also such, like the seeds of Paullinia, bruised into a pulp and formed into cylindrical rolls or flat cakes, wood charred to charcoal, etc. The main characteristic of this group, as distinguished from the last, is that drugs of this group show unmistakably that they were thus altered, while some of the drugs of the last group may also have been altered but do not show it so plainly.

Most of the drugs of this group have already been described, and the numbers following their names refer to the pages where this occurs; a few are here described for the first time, however, because they never come into trade otherwise than as thus altered. Cut woods and parts of fruits, etc., which are readily recognizable as such, are not mentioned here because it is easy to refer to the proper group at once.

Cylindrical or cake-like masses, very hard, reddish-brown; odorless .... **Guarana**.

Black pieces, having the structure of wood, but consisting mainly of carbon; or black, odorless and tasteless powder, not gritty............... **Carbo Ligni**.

Irregular brown-black masses, partly membranaceous, partly pulverulent .... **Ustilago**, 125.

White, tough, light masses........................ **Agaric**, 126.

Thin, brown, pliable, velvety sheets.............. **Spunk**, 126.

Small, conical, light-brown, peeled, or glossy, dark-brown, unpeeled pieces of fronds mixed with pieces of rhizome............ .... **Aspidium**, 130.

Fragments of light porous roots, with thin grayish-brown bark, under which is a net-work of lighter-colored fibro-vascular bundles.......... **Methysticum**, 175.

Short, brownish-gray sections, wood spongy and bark easily separable, and flaring at cut ends.. **Stillingia**, 180.

Tough, spongy sections with irregular bundles..... **Sumbul**, 189.

Transverse and longitudinal sections of a thick, fleshy root with radiating bundles; grayish-brown .... **Inula**, 192.

Large, round or plano-convex, orange-yellow pieces of root, peeled.............................. **Rheum**, 201.

Transverse sections, greenish-gray outer surface, yellowish on cut surfaces.................... **Calumba**, 204.

Grayish-white transverse sections, hard, with prominent radiating and concentric lines............ **Bryonia**, 205.

Decorticated roots, externally and internally white, mealy and fibrous......................... **Althæa**, 206.

Small, cubical, white pieces, about 3 to 4 mm. in size; peculiar odor.......................... **Althæa**, 207.

Longitudinal and transverse sections, with projecting white wood-bundles alternating with yellowish-gray parenchyma........................ **Phytolaccæ Radix**, 207.

Obconical, blackish-gray, with shriveled lighter-colored rootlets; sometimes cut into halves or quarters longitudinally, or into transverse slices .... **Veratrum Viride**, 215.

Obconical to subglobular, annulate, orange-brown; sometimes cut into transverse slices which are grayish-brown; slices sometimes strung on strings .... **Trillium**, 217.

Longitudinal slices of rhizome, yellowish-brown, whitish within; show traces of nodes.......... **Polygonatum**, 220.

Long, slender, yellowish-brown longitudinal slices of rhizome; in section plano or concavo-convex; taste aromatic .... **Calamus**, 239.

Thin, straw-like pieces, hollow, about 1 cm. long.... **Triticum**, 240.

Slender, nearly straight pieces, smoothly trimmed, 6 to 8 cm. long, white or cream-white, perforated at one end.......................... **Finger Orris**, 246.

Ovate orange-brown disks or longitudinal slices of a thick rhizome; or circular transverse slices; odor and taste resembling ginger.............. **Zedoaria**, 247.

Kidney-shaped grayish-white slices................ **Colchici Radix**, 257.

Transverse slices with dark-gray epidermis and mealy-white surfaces .... **Arum**, 259.

Narrow slices, up to 5 cm. long, 10 to 15 mm. broad, yellowish, diaphanous, brittle................ **Scilla**, 262.

Short, pale, grayish-green pieces of twigs, with smooth-cut ends; usually hollow............... **Dulcamara**, 270.

Slender, cylindrical, sometimes curved pieces, spongy or pithy, white.......................... **Sassafras Medulla**, 273.

An irregularly coarse, grayish-brown powder, mixed with many tough coarse fibers................**Quercus Alba**, 349.

Leaves rolled into small pellets or cylinders; grayish-green, bluish-green to blackish............**Thea**, 359.

Separate stigmas, or three attached to a style, linear-tubular, about 3 cm. long; deep orange-brown with reddish tinge....................**Crocus**, 405.

Oval grains about 3 to 4 mm. long, or round grains half as large, yellowish-white, whiter at ends, yellowish-brown groove along one side........**Hordeum Perlatum**, 466.

Orange-red, irregularly lobed, fleshy bands; fragrant; often broken..........................**Macis**, 498.

For some of these drugs only the reference to the proper page is necessary; in regard to others, a few remarks in addition to what has already been said may be of help. And some of the drugs belong in this group and nowhere else, and these are described in full here.

Guarana

N. Guarana.—**O**. A dried paste consisting mainly of the crushed or pounded seeds of *Paullinia Cupana (P. sorbilis); Sapindaceæ*.—**H**. Tropical South America, especially Brazil.—**D**. Cylindrical sticks, rounded at the ends, looking somewhat like Bologna sausages, about 15 cm. long and 2.5 to 4 cm. thick, very hard, dark reddish-brown, slightly mottled and comparatively smooth: or in subglobular or flattened cakes having the same external appearance as the sticks; fracture uneven, somewhat glossy, reddish-brown, but paler than the external surface, not homogeneous, but mottled and marbled from fragments of seeds enclosed in their darker-colored seed-coats; odor feeble but peculiar, reminding of chocolate, and taste bitter astringent.—**C**. Partly soluble in alcohol or water, yielding a brown solution with either menstruum. The important constituent is caffeine, of which the drug contains from 4 to 5 per cent.—**U**. Guarana resembles tea and coffee in its effects; it is used mainly to relieve sick headache. Dose: 1 to 5 grams, best in fluid extract or elixir.

Carbo Ligni

N. Charcoal, Vegetable Charcoal.—**O**. Charcoal prepared from soft wood, very finely powdered. The charcoal made from small

willow or poplar shoots is most esteemed for medicinal purposes.—**D.** Charcoal retains the shape and structure of the wood from which it was prepared, but consists only of the carbon together with the mineral substances which constitute the ash when wood is burned. As usually met with by the retail pharmacist, vegetable charcoal is a fine black powder which should be free from grit, and should leave, when burned with free access of air, not more than 7.5 per cent of ash; tasteless and odorless.—**C.** If properly prepared it should contain no uncarbonized wood, which may be tested by boiling 1 gram of charcoal with a mixture of 3 c.c. 5 per cent solution of potassium hydroxide and 5 c.c. of water; after boiling for several minutes, filter; complete carbonization is shown by the filtrate being colorless or nearly so.—**U.** Used in the arts and manufacturing as a deodorizer and decolorizer. When taken internally it absorbs some of the gases and fluids in the alimentary tract, and is useful in heartburn, eructations of gases or sour fluid, flatulence and dyspepsia. Dose: One or two teaspoonfuls mixed with water.

Powdered vegetable charcoal may be readily distinguished from powdered animal charcoal by incineration, leaving less than 7.5 per cent of ash, while animal charcoal leaves about 85 per cent of ash; moreover animal charcoal has a dull black color and is gritty.

GROUP LXXI

Trichomes

The word "trichome" means an outgrowth from the epidermis-cells of the plant, and includes vegetable hairs in all their modifications, as root-hairs, woolly hairs, prickly hairs, glandular hairs and glands, simple hairs, branched hairs, etc.; vegetable hairs used in medicine are of single cell thickness, thus differing from corn-silk, for example, which might by some be mistaken for vegetable hairs; sometimes a hair becomes developed into a thickened portion, when it is a glandular hair, and in some cases the hair structure is no longer readily perceived for it has developed into a more or less rounded structure and is then called a gland.

Only a careless observer might look here for saffron or corn-silk, but the spores of lycopodium and of corn-smut might very

easily be mistaken for glands. All these substances are therefore mentioned here, with reference to the pages where they are described.

The drugs of this group are best examined under a fairly high magnifying power of the microscope, although their identity can be established without this aid.

Vegetable glands

Granular, mobile, brick-red powder; no odor and little taste .... **Kamala.**
Brownish-yellow to yellowish-brown powder; aromatic and bitter .... **Lupulinum.**

Vegetable hairs

Delicate white curling hairs, from 2 to 4 cm. long...... **Gossypium.**
Glistening, brownish-red silky powder, consisting of hairs about 2 to 3 mm. long.......... **Mucuna.**
Curling, glossy-brown, soft and delicate hairs, from 2.5 to 5 cm. long.......... **Penghawar,** 133.

Liable to be taken for trichomes

Irregular, brown-black masses, partly membranaceous, partly pulverulent .... **Ustilago,** 125.
Light-yellow, very mobile powder.......... **Lycopodium,** 128.

Hardly liable to mistake

Separate stigmas, or three attached to a style, lineartubular, about 3 cm. long; deep orange-brown with reddish tinge .... **Crocus,** 405.
Tufts of soft, silky, thread-like, yellowish fibers, about 15 cm. long; the ends often matted together and dark brown .... **Zea,** 407.

Kamala

N. Kamala, *Glandulæ Rottleræ.*—**O.** Glands and hairs from the capsules of *Mallotus Philippinensis (Rottlera tinctoria); Euphorbiaceæ.*—**H.** India, China, Philippine Islands, etc.—**D.** To the unaided eye Kamala appears as a granular, mobile, brick-red powder, slightly gritty under the teeth; burns similar to lycopodium when blown through a flame; not readily miscible with water; imparts but little color to water even when boiled in it, but yields a deep-red solution when alkalies are added, or in alcohol or ether; under the microscope the powder is seen to consist of

irregular oval or round glands (more or less opaque as in *a*, Fig. 447) mixed with colorless or brownish hairs arranged in stellate clusters (*d*); when cleared with diluted solution of potassium hydroxide the gland appears as in *b*, and when crushed under the cover glass there are seen a colorless enveloping membrane and 60 to 80 little bladder or sac-like vesicles which were attached to each other at a common center and which contain a red substance; nearly devoid of odor and taste.—**C.** About 80 per cent resin, rottlerin, etc. It should leave only about 8 per cent of ash; a larger proportion of ash is due to adulteration with earthy mat-

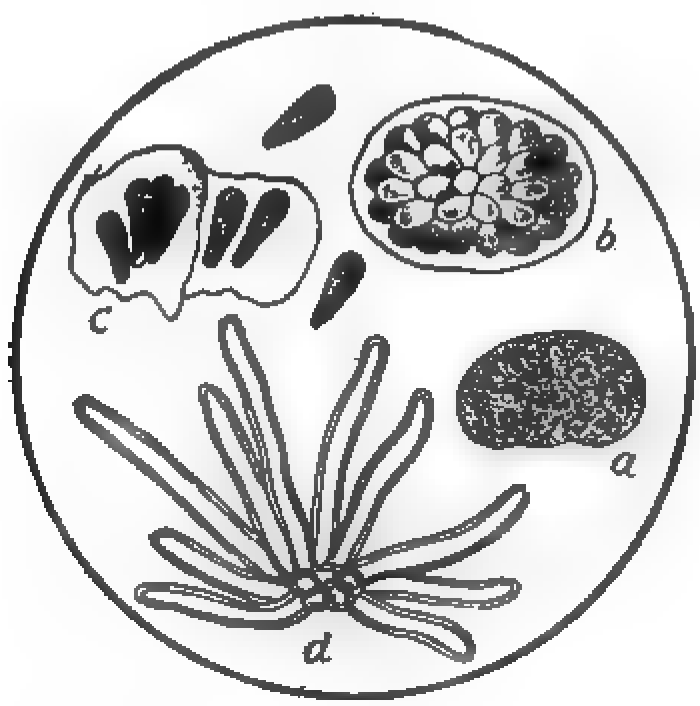


Fig. 447.

ter, which sometimes constitutes the bulk of the drug.—**U.** Tænicide and purgative. Dose: 5 to 10 grams.

Very pronounced grittiness under the teeth should lead us to suspect adulteration with sand; it is always best to examine this drug with the microscope to determine its quality.

Lupulinum

N. Lupulin.—**O.** Glands from the axis and bracts of hops, the strobiles of *Humulus Lupulus; Urticaceæ*.—**H.** Cultivated.—**D.** When fresh, a golden-yellow, afterwards brownish-yellow to orange-brown powder, consisting of minute granules or mush-

room-shaped glands, which contain a yellow balsamic fluid in a reticulate cellular membrane; odor aromatic, taste bitter.—**C.** 3 per cent volatile oil, resin, etc.; should not yield more than about

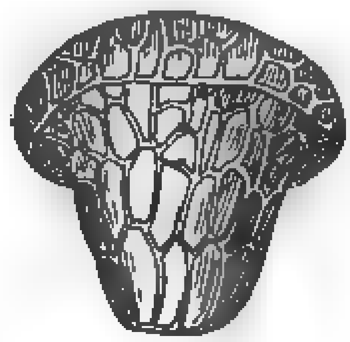


Fig. 448.

12 per cent of ash on incineration. Ether dissolves about 60 per cent of the drug.—**U.** Stimulant tonic; anodyne, especially on genito-urinary organs. Dose: 0.3 to 1 gram.

Gossypium

N. Cotton.—**O.** Hairs from the seeds of *Gossypium herbaceum* (or of other varieties of *Gossypium; Malvaceæ*.—**H.** Cultivated in tropical and sub-tropical countries.—**D.** Delicate, white, soft, curling hairs, consisting of one-celled filaments varying in length

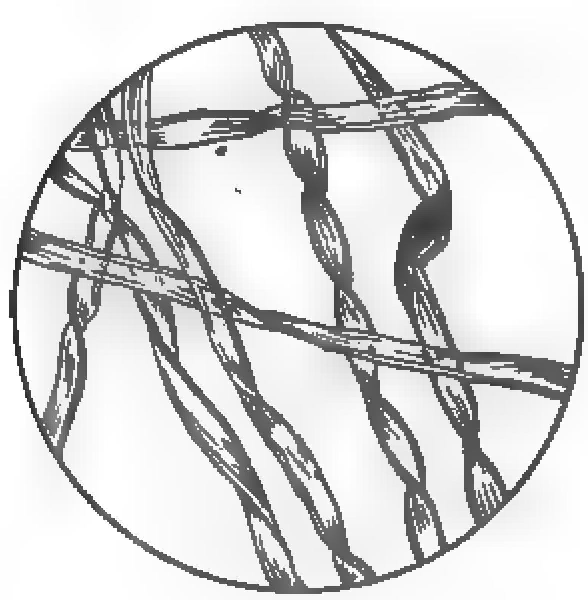


Fig. 449

from about 2 cm. ("short staple") to 4 cm. ("long staple") and about 0.05 millimeter thick. These hairs are simple cells and though round when fresh in the pod, collapse when gathered and

dried, and then present a spiral and band-like appearance under the microscope. Odorless and tasteless, and insoluble in water, alcohol, ether and solutions of caustic alkalies.—**C.** Mainly cellulose, about 10 per cent fixed oil and some inorganic matter; it leaves about 1.5 per cent ash.—**U.** For preparing collodion, absorbent cotton and various surgical dressings; also for filtering, straining liquids, etc.

By boiling in weak solution of caustic lye the oil is saponified and removed, and this purified cotton is known as "absorbent cotton," because it absorbs moisture with great avidity.

Mucuna

N. *Pili Stizolobii,* Cowhage.—**O.** The hairs from the pods of *Mucuna pruriens (Stizolobium pruriens); Leguminosæ.*—**H.** East

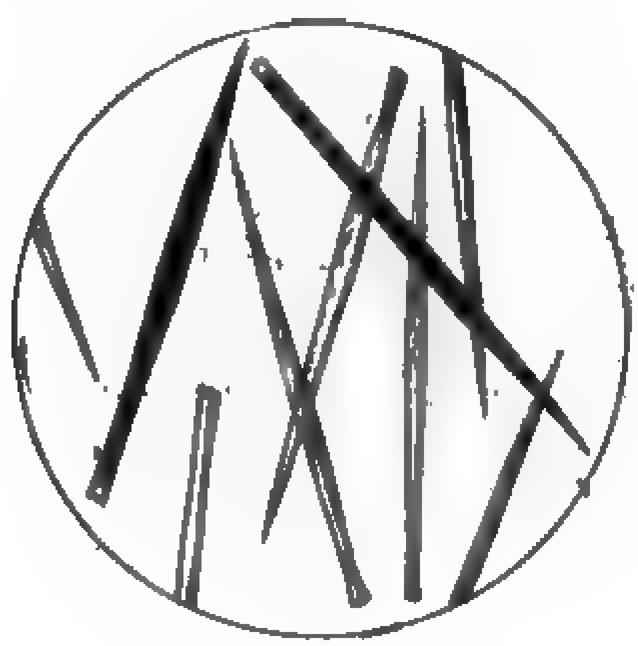


Fig. 450.

and West Indies.—**D.** Glistening, brownish-red, silky powder, seen under a lens to consist of stiff, pointed and barbed hairs about 2 to 3 mm. long; odorless; they penetrate the skin very readily and cause severe itching which is aggravated by rubbing or scratching, but is relieved by wetting with water which softens the hairs.—**C.** A little tannin and resin.—**U.** Formerly used as a vermifuge, mixed in molasses, but now seldom employed, except perhaps by dishonest horse-traders who are said to make broken-down horses appear spirited by applying cowhage to the anus or genitals.

GROUP LXXII

Excrescences or Galls

Galls are peculiar excrescences or tumors produced by the stings of various insects on many different plants; the female insect bores a hole with her ovipositor and deposits her eggs, and the stimulation or irritation produced thereby causes an abnormal cell-proliferation which results in the formation of the gall. Within this gall the ovum of the insect is hatched and forms a larva or grub which feeds on the surrounding vegetable tissue, so that a cavity is formed near or at the center of the gall; the grub finally develops into a perfect fly or insect which eats its way out, so that a tubular canal is formed from the central cavity to the outer surface.

It is sometimes stated that galls are best before the insect has eaten its way out; those galls are supposed to be best which have no hole on the outer surface; such galls are supposed to be the "blue," "green" or "black galls," while those with holes in them are supposed to be mainly "white galls." The writer is convinced that the gall (what there is left of it) after the insect has eaten a hole to the surface, is just the same as the gall without such a hole; of course, it is lighter; but as with the man who bought a pound of Swiss cheese and complained of the large holes in it, and was told by the grocer that after he had eaten the cheese he should return the holes and the grocer would return full value for whatever the holes might weigh, so the lightness of perforated galls is compensated for by the greater number to the pound; what there is of the perforated gall is as good as an equal weight of one that is not perforated. When a gall is gathered and dried before the insect has matured the latter dies and the gall remains unperforated.

Round, hard, more or less nodulated, about 2 cm. in diameter; dark-colored; often with round holes.................. **Galla.**

Irregularly lobed, hollow, thin-walled, slightly downy or smooth, brownish .... **Chinese Galls.**

Similar to last, but hairy and grayish..................... **Japanese Galls.**

Round, spongy, orange or yellowish-brown, up to 5 cm. or more in diameter.................................... **American Galls.**

Galla

N. Galls, Nut-galls.—**O.** Excrescences on *Quercus infectoria* and allied species of *Quercus; (Cupuliferæ);* caused by the punctures made by the female of *Cynips Gallæ tinctoriæ,* while depositing her eggs.—**H.** The Levant.—**D.** Fig. 451 shows galls whole and in section, with and without holes, all natural size. Galls are globular, about 1 to 2 cm. in diameter, nodulated on side opposite point of attachment, otherwise smooth, heavy, hard, often with a perforation extending from the central cavity; externally dark olive-green, or bluish-brownish-green, or blackish-green; internally yellowish-gray, darker towards center; fracture brittle and granular; the cavity in center has a hard wall

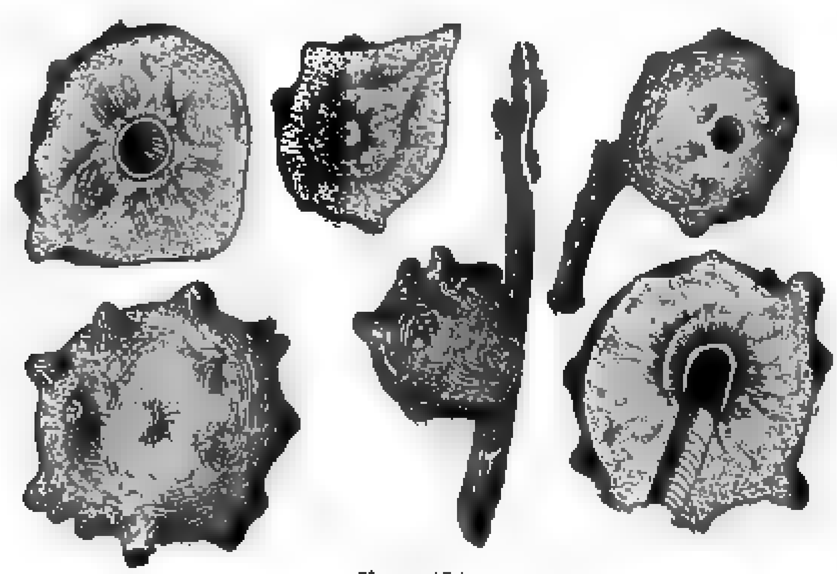


Fig. 451

and occasionally contains a dead grub or imperfectly developed insect, or in case the insect has escaped, the debris caused by it; odor none and taste very astringent.—**C.** From 40 to 75 per cent tannin and 2 to 3 per cent gallic acid, etc.—**U.** Astringent. Dose: 0.5 to 1 gram. Mainly used for making tannic and gallic acids.

Dark-colored and heavy nut-galls are usually good, and light-colored, light and spongy galls are usually inferior. This difference does not appear to be dependent on whether the gall is perforated or not, and there is no difference between galls with holes and without holes, other things being equal.

Aleppo (or Syrian) galls are best, and these are shown in Fig. 451.

For the manufacture of tannic and gallic acids, galls from dif-

ferent sources are also employed. For instance, **Chinese galls** which are hollow, irregularly lobed, thin-walled, usually grayish-brown and slightly downy, nearly smooth; see Fig. 452, in natural size. **Japanese galls** resemble the Chinese, but are rather more downy, and grayish in color; both are occasionally closed and peduncled at base.

American galls from *Quercus lobata*, are large, up to 5 cm. in

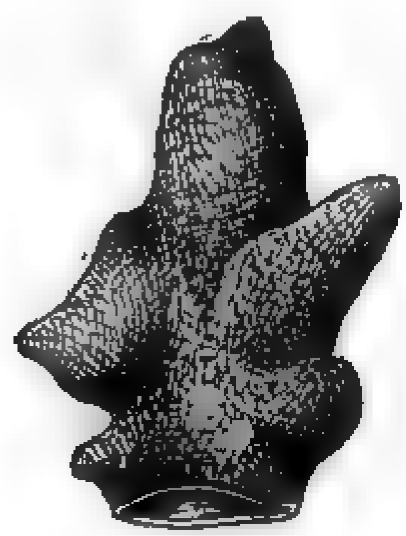


Fig. 452.

diameter, orange or yellowish-brown, spongy and very astringent. Galls from sumach and other plants are also employed in manufacture and in tanning, but only the Aleppo (Syrian) oak-galls described above are of special interest to the pharmacist.

VEGETABLE DRUGS WITHOUT CELLULAR STRUCTURE

A small portion, the merest shred, of a cellular drug put on a microscope slide and cleared with a drop of solution of potassium hydroxide, covered with a cover glass, then examined under the microscope, will show cellular structure; if it does not show this, it is a drug showing no cellular structure, and may be either an animal or a vegetable drug. If of animal origin, it will probably cause a strong or disagreeable odor when burned on a hot stove lid, or in a flame, while if it is a vegetable drug, the products of combustion are odorless, or at least not of the peculiar character which distinguishes burning animal matter; the test being, in fact, the same that is applied by every housewife to determine whether the cloth she has bought, or of which she has a

sample, is really woolen or not. The test is not always applicable, however, because a few animal substances may produce little or no odor on burning, while the reverse is true in regard to a few vegetable drugs.

However, the test will almost always enable us to say whether the non-cellular drug under examination is a vegetable drug or not, the microscope having determined already that it is non-cellular.

The drugs of this general class may be divided into two subdivisions, according to their appearance under the microscope, for some of them show regular and organic structure, although not cell-structure:

Non-cellular vegetable drugs	Definite granules	LXXIII
	Amorphous	LXXIV to LXXXVI

GROUP LXXIII

Definite Granules Under Microscope

This group comprises the starch grains; as these are only part of the cell-contents, and as "cellular structure" means "composed of cells," it is evident that starches have no cellular structure, although they have organic structure.

The nature of starch and its relation to the plant economy is supposed to have been studied in the lessons on botany, but a few words of recapitulation will not be amiss. Starch is plant-food which is stored up for future use. It is formed from the inorganic food of the plant by the chlorophyll-bodies in sunlight; it ceases to be formed when the plant is in the dark. After having been formed in the green part of the plant, it may undergo a change into glucose and be conveyed to other parts of the plant, even those that are in the dark under the soil, as in the tubers of the potato, for while it cannot be originated from inorganic elements by protoplasm in the absence of light (or even in the light, for it requires chlorophyll, not protoplasm, to form it) it can nevertheless be deposited by protoplasm from the solution of glucose in the cell-sap. An extremely small grain of starch is first deposited consisting of starch-cellulose; within this is then deposited a softer particle of starch consisting of starch-

granulose which forms the *hilum*, and then around this hilum there are deposited, by intussusception, alternating layers of the denser starch-cellulose and the softer starch-granulose, thus giving the starch grains the appearance of being made up of concentric layers around the hilum, which latter is usually excentric.

According to the needs of the growing plant, these starch-grains, once they have been formed by the chloropyhll-bodies, can be changed to sugar and reformed and redeposited elsewhere, as often as it may be necessary.

Starch grains are usually rounded or oval, but if a cell is crowded with many grains, they may assume more or less angular forms; the size of the starch grains may vary from about $\frac{1}{10}$ of a millimeter, in potato starch, to $\frac{1}{1200}$ of a millimeter, in a variety of chenopodium; but the grains may also vary in size in the same plant, as we find, for example, quite small and quite large grains in the tuber of the potato, while the grains of starch in the seeds of Indian corn are remarkably even in size. Moreover, the general appearance or shape of the grains of starch is sufficiently characteristic in certain plants, to enable us to identify them under the microscope.

That starch grains are colored blue by iodine, and that they polarize light, giving a "polarization-cross," has already been explained.

Starch is insoluble in water; alcohol or ether; if boiled in water, it swells into a jelly-like paste, but does not dissolve.

There is little difference between the various starches as far as their use in concerned, and therefore the cheapest source is usually utilized, so that potato and wheat starches are mainly used in Europe, while corn starch is extensively employed in America. For special purposes, however, wheat, rice, arrowroot and other starches are used, and a short description of these trade articles will be given.

Most of the starches are white powders, but in bulk they often occur in peculiar prismatic columnar pulverulent lumps, as in ordinary laundry starch, or in peculiar grains, as in sago or tapioca. Starch grains are fairly characteristic in appearance under the microscope, and although it might be difficult or impossible to determine the origin of any single granule, the appearance of a microscopical field of them is characteristic. The different

starches figured are all enlarged at the same rate, about 250 diameters, so that it will be seen that the size as well as the shape is of diagnostic value in identifying these drugs.

The student will do well to study also the starches of turmeric, beans, peas, etc., because these substances are sometimes used as adulterants for powdered drugs of various kinds. It must be recalled to mind, that in examining powdered drugs the same rule holds good that is used in examining whole drugs, namely, that we determine the structure and appearance of the pure drug, then if there is anything present that is not of the pure drug, it must be an adulteration or admixture, in which case we reject the drug, no matter whether we can determine what the adulterant is, or not.

Starches are used as food; in medicine as demulcents; and extensively in the arts, for sizing, in laundering, etc.

The more important starches have microscopical characteristics, as follows:

Polyhedric granules often adherent in clusters; uniform, with well-marked hilum.......................... **Corn Starch.**

Lenticular or oval, medium-sized and small granules; layers and hilum indistinct....................... **Wheat Starch.**

Ovate, large, layers very distinct; hilum at narrow end, small, but distinct.............................. **Potato Starch.**

Polyhedric or angular, very small, uniform; hilum and layers indistinct .... **Rice Starch.**

Ovate, medium-sized, layers and hilum distinct; hilum at broad end and often cracked or cleft............... **Arrowroot Starch.**

Medium-sized, ovate, oblong, elliptic or irregular, often truncate at one end; layers and hilum distinct, the latter generally cleft............................ **Sago Starch.**

Medium-sized, irregular, often muller-shaped granules; layers indistinct; hilum near rounded end........... **Tapioca Starch.**

In macroscopical appearance most of the starches are in powder or in lumps that are easily reduced to powder by pressure between the fingers, but the following appear in peculiar lumps:

Small, round, pearly, white or brownish, opaque or slightly translucent lumps .... **Sago.**

Irregular lumps, white and opaque, or slightly translucent........ **Tapioca.**

Amylum

N. Corn starch, *Maydis Amylum.*—**O.** The fecula of the seed of *Zea Mays; Graminaceæ.*—**H.** America; cultivated in other countries.—**D.** Granules polyhedric or angular from mutual compres-

Fig. 453.

sion within the cells, often adherent in clusters, uniform in size, with large, well-marked central hilum but indistinct layers; white; odorless and tasteless.

This is the official U. S. P. variety of starch.

Tritici Amylum

N. Wheat Starch.—**O.** The fecula of the grain or seed of *Triticum sativa; Graminaceæ.*—**H.** Cultivated in temperate zones.—

Fig. 454.

D. White powder; the granules rather small or medium-sized. but mixed with many quite small granules with but few of intermediate sizes; lenticular or oval; layers and hilum indistinct; odorless and tasteless.

Tuberis Solani Amylum

N. Potato Starch.—**O.** The fecula of the tuber of *Solanum tuberosum; Solanaceæ.*—**H.** Cultivated generally.—**D.** White powder or pulverulent lumps; the granules large, ovate or oblong,

Fig. 455.

frequently in twin-granules, layers very distinctly marked, the hilum small and near the narrower end, and rarely cracked or cleft.

Oryzæ Amylum

N. Rice Starch.—**O.** The fecula of the grain or seed of *Oryza sativa; Graminaceæ.*—**H.** Cultivated generally.—**D.** A very fine

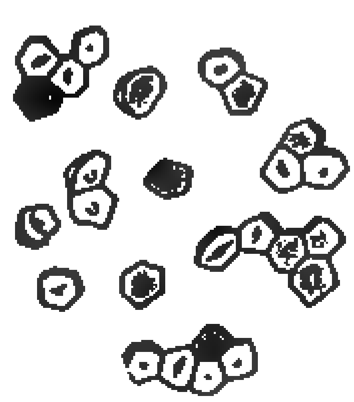


Fig. 456.

white powder; the granules are very minute, by far the smallest of the commercial starches, polyhedric or angular, uniform in size, layers and hilum indistinct.—**U.** Owing to the extreme fine-

ness of powdered rice starch this variety of starch is most generally employed in the manufacture of toilet articles, such as face-powders, etc.

Marantæ Amylum

N. Arrow root.—**O.** The fecula of the rhizome of *Maranta arundinacea; Marantaceæ.*—**H.** West Indies; cultivated in tropical countries.—**D.** Light white powder, or pulverulent lumps; produces a peculiar crackling sound and feel when a package of it is compressed between the fingers; should be odorless and taste-

Fig. 457.

less, but is sometimes musty, when it should be rejected. The granules are of medium size, ovate, oblong, sometimes truncate, with delicately marked layers, and a distinct hilum near the broader end, the hilum generally cracked or cleft in stellate or cross-shaped manner.

Sago

N. Sago; the word is indeclinable and neuter.—**O.** The fecula of the pith of several varieties of sago palms, different varieties of *Metroxylon, Raphia, Saguerus, Phœnix, Cycas, Zamia,* etc.; but usually ascribed to *Metroxylon Sagu (Sagus Rumphii)* and other palms; *Palmæ (Palmaceæ).*—**H.** Tropical countries.—**D.** The word "sago" refers to the product of a process of treating starch (any

starch) so as to form the peculiar grains so well known under this name; so that, while sago is mainly prepared from the starch of various palms, it has been made from potato and other starches. The process consists in heating the still moist starch at a temperature of 60° to 70° C., by which many of the grains are changed, becoming gelatinous masses; after having been thus heated, the mass is granulated and dried, thus forming the little round, pearly, white or brownish, opaque or slightly translucent lumps which constitute the trade article. While most of the granules are altered by this process, some of the granules remain unchanged, and these appear under the microscope as medium-sized, oblong, elliptic, irregular granules, often truncate at one end; layers and

Fig. 458.

hilum both distinct, the latter often cracked or cleft.—**U.** Altogether for culinary purposes; as diet for the sick or invalids.

Tapioca

N. Tapioca.—**O.** The fecula of the rhizome of *Manihot utilissima (Jatropha Manihot); Euphorbiaceæ.*—**H.** Brazil; cultivated in tropical countries.—**D.** The starch from one variety of this rhizome (cassava starch) is mixed with a poisonous milky juice, which is removed by washing, the poisonous substance is volatile and if a little remains in the starch it is dissipated in the cooking. The starch is prepared for the market in a manner similar to that in which sago is prepared, but it is not granulated in the same manner. Tapioca is in irregular, hard, white, rough grains or

lumps, opaque or slightly diaphanous, with most of the starch granules changed in shape; the unchanged granules of starch are medium-sized, irregular, often muller-shaped, with indistinct

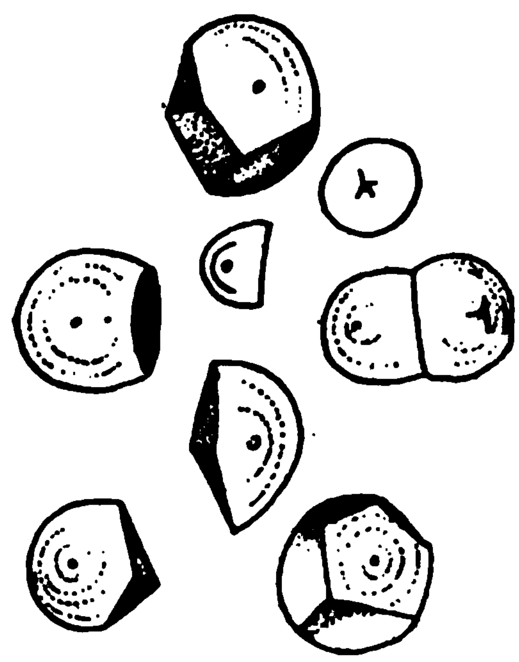


Fig. 459.

layers, and the hilum near the rounded end.—**U.** Altogether for culinary purposes; as diet for the sick and invalids.

AMORPHOUS VEGETABLE DRUGS

To a certain extent, although not altogether, the basis of grouping these drugs is their chemical constitution. In regard to quite a number of the drugs of this class, there may be reasonable differences of opinion whether we are to consider them as drugs or as preparations. If we consider them as drugs, they must be described in works on pharmacognosy; if as preparations, they should be described in works on pharmacy. Thus, some authors describe citric acid as a drug, others do not; we will therefore recall the definition given for the word "drugs" at the outstart of this book: "Drugs are the organic substances used in medicine or in the arts in the crude form in which they are brought into trade." For example: Catechu is made by boiling chips, etc., of a tree in water, straining and evaporating the decoction to solid extract consistence; this is done where the tree grows; the wood is not sent into trade, but this extract is the crudest form in which we get the article; catechu is therefore a drug. Extract of logwood is made in precisely the same way as is catechu, but the wood is imported (this is therefore the drug) and the extract

is made here or in Europe (where also the wood is imported), and the extract is therefore a preparation.

On the other hand: Extract of licorice is extensively manufactured from the roots where the roots are grown and it is sent into market from there; it is therefore like catechu and may be called a drug; but enormous quantities of the root (drug) are imported and manufactured into extract in this country; the extract is therefore like the extract of logwood, a preparation; what then is it? a drug or a preparation? We will call it a drug, but others have just as much right to deny that it is a drug and they may call it a preparation.

No apology is necessary, therefore, if drugs are enumerated here that others may not recognize as drugs, nor if the contrary is the case. If any error is made, it is better to describe too many articles as drugs, rather than to omit important ones.

Formerly the author classified drugs of this class as "Mixture of granular and formless material" and "Homogeneous under microscope" (following Schleiden in this regard); the first of these groups included, for example, opium, because the epidermal cells of the poppy capsules are necessarily included. However, this is clearly an accidental, even though unavoidable, admixture, and the opium itself is homogeneous in structure.

If a vegetable drug of cellular structure is placed in water it will swell, but it retains its structure; if a non-cellular amorphous vegetable drug is placed in a proper solvent, water, dilute alcohol or alcohol, it does not retain its shape, but disintegrates, and any accidental cellular or other impurities or debris will sink as a sediment, if there be any. It is therefore not necessary to retain the above mentioned distinction, and drugs of this class are grouped as follows:

AMORPHOUS VEGETABLE DRUGS

Acids	LXXIV
Juices	LXXV
Extracts	LXXVI
Sugars	LXXVII
Gums	LXXVIII
Gum-Resins	LXXIX
Resins	LXXX
Oleo-Resins	LXXXI

GROUP LXXIV

Acids

Only two acids can fairly be called drugs, citric and tartaric; all other acids, such as acetic, benzoic, carbolic, crude pyroligneous, salicylic, etc., are more properly called preparations.

Colorless, right-rhombic crystals, deliquesce in moist air; acid taste ....**Acidum Citricum.**
Colorless monoclinic prisms, or crystalline crusts; permanent in air; acid taste........................**Acidum Tartaricum.**

Acidum Citricum

N. Citric Acid.—**O.** Usually prepared from the juice of the lemon, *Citrus medica Limonum; Rutaceæ (Aurantiaceæ)*, but also from the fruits of other varieties of *Citrus (limes)*.—**H.** Cultivated in subtropical countries.—**D.** Colorless, translucent, right-rhombic prisms; efflorescent in warm dry air and deliquescent in moist air; odorless, and with an agreeable, purely acid taste.—**C.** Admixture of tartaric acid may be detected by dissolving 1 gram of citric acid in 5 c.c. of a solution of potassium acetate (1 in 3), then adding an equal volume of alcohol; the solution will become turbid if tartaric or oxalic acid is present. See also pharmacopœial tests.—**U.** Refrigerant; also used in making various pharmaceutical chemicals. Dose: 0.3 to 2 grams.

Acidum Tartaricum

N. Tartaric Acid.—**O.** Prepared from argols (crude cream of tartar), a peculiar substance deposited on the inside of wine casks during the fermentation of the grape juice into wine. (From *Vitis vinifera; Vitaceæ)*.—**D.** Colorless, translucent, monoclinic prisms, or crystalline crusts; more commonly found in the drug trade as a white powder; permanent in the air; odorless, and

with an agreeable, purely acid taste.—**C.** See pharmacopœial tests for purity, etc.—**U.** Refrigerant; also used in making various pharmaceutical chemicals. Dose: 0.3 to 2 grams.

GROUPS LXXV AND LXXVI

INSPISSATED JUICES AND EXTRACTS

Group LXXV includes substances which are fluids in the living plants, and which are obtained by making incisions, etc., when they exude, after which they are inspissated to solid extract consistence. They are soluble, or at least partially soluble, in water.

But we arbitrarily limit this group to such inspissated juices that dissolve more or less completely in water, for otherwise gutta percha, caoutchouc, crude turpentine, Peruvian balsam, etc., would also be "juices."

A strictly scientific classification in pharmacognosy should be based on physical characteristics that can be recognized in the drug itself, so that a classification of volatile oils adopted by one author as "from rhizomes, from woods, from barks, from leaves, from herbs, from flowers, from fruits, from seeds, from oleoresins, from stearopten, from resin" can be of no value whatever in pharmacognosy, because it is impossible to tell by a mere inspection or examination of an unknown volatile oil, from which of these sources it was obtained, leaving out of consideration the fact that when a "resin" can yield a volatile oil, it is not a resin, but an "oleo-resin."

So the above definition of inspissated juices, that they are more or less completely soluble in water, is not sufficient to sharply define this group from the next group, the extracts. Extracts are solid plant-cell contents, and are dissolved out from their various plant-sources by boiling in water, then evaporating to solid extract consistence. They also dissolve more or less completely in water.

There is no distinctive characteristic by which we can differentiate drugs of the two groups except, in a general way, the greater solubility of extracts in water alone, and these two groups might have been placed together, possibly with more propriety than to keep them separate. It must be admitted that other writers, Maisch for instance, had good cause to make one group

of "Extracts and Inspissated Juices;" on the other hand, it adds much to the students' understanding of the nature of the individual drugs if they are grouped as is done here.

In order, however, to avoid any difficulty that might arise from an inability to distinguish the drugs of these two groups by any physical characteristics, they are enumerated and compared with each other in one synopsis or descriptive list.

Of course, the preparations known as "succi" or "juices" (of the British pharmacopœa), or the "solid extracts" (of our own and other pharmacopoeias) have nothing in common with this group in a system of pharmacognosy. They are "preparations," pure and simple.

Guarana might readily be taken for an extract or inspissated juice, unless a bit of it is examined under the microscope, and it is, in fact, grouped with these drugs by Maisch. It is included in the synopsis, with reference to its proper group.

Inspissated Juices **(Group LXXV)**

Irregular subglobular cakes, brown, with remnants of leaves or rumex fruits adhering; heavy narcotic odor .... **Opium.**

Hard, orange-brown, opaque masses, with resinous fracture; odor suggests saffron .... **Aloe.**

Small, angular, shining, brittle pieces, ruby-red, transparent in small fragments; odorless .... **Kino.**

In quarter-sections of plano-convex cakes, or in irregular pieces; grayish-brown .... **Lactucarium.**

Extracts **(Group LXXVI)**

Irregular broken masses, brittle, dark-brown; sweetish astringent taste .... **Catechu.**

Dark-brown, almost black cakes or fragments; often cakes enclosed in paper-boxes .... **Logwood Extract.**

In round black sticks with an impression of trademark at one end; or in large, black masses or lumps; very sweet .... **Liquorice Extract.**

Sometimes in flat, scaly fragments; more commonly as a thick extract-like mass, in jars .... **French Lactucarium.**

Apt to be mistaken for an extract

Cylindrical or cake-like masses, very hard, reddish-brown; odorless .... **Guarana.**

(See Guarana, Group LXX.)

Opium

N. Opium, *Thebaicum.*—**O.** The concrete, milky exudation obtained by incising the full-grown but not yet ripe capsules of *Papaver somniferum; Papaveraceæ.*—**H.** Western Asia; cultivated.—**D.** The milky juice which exudes when incisions are made in the poppy capsules, becomes concrete and turns brown in color; it is gathered and formed into lumps, which are wrapped in poppy leaves and packed with rumex-capsules. Opium is in subglobular lumps or cakes, irregularly angular from mutual compression, being packed while still somewhat moist; the leaves and sometimes rumex-capsules adhere to the outer surface; varying in color from chestnut-brown to dark-brown and in consistence from quite dry and rigid to semi-plastic, according to the amount of moisture retained; granular in fracture, and mixed with shreds of the epidermis of the capsules; odor heavy narcotic and taste nauseous bitter.—**C.** The most important constituent is morphine, of which opium in its usual moist condition should contain not less than 9 per cent; when dried and powdered, opium should contain from 12 to 12½ per cent of morphine, and the average of this may be obtained by mixing opium of higher assay with a proper quantity of opium of lower assay. In addition to morphine, opium contains about 10 per cent of narcotine, about 0.2 to 0.7 per cent codeine, and about 15 other, unimportant, alkaloids.—**U.** Narcotic anodyne, anti-spasmodic, hypnotic; used also to check discharges from the bowels. Dose for adults: 0.05 to 0.1 gram; should be given to children with great caution. It is usually better to give in divided doses, even to adults.

In large doses, opium is a narcotic poison. Antidotal treatment consists in prompt evacuation of the stomach, preferably by means of stomach pump or tube, keep patient awake by walking him about, cold douches, flagellation if necessary, and by giving stimulants internally, such as strong coffee, alcoholic liquors, and atropine subcutaneously.

Varieties: Turkey opium, also called Constantinople or Smyrna opium, is the usual trade article, as described above. Egyptian opium in flattish cakes, Persian opium in sticks wrapped in paper, and Indian opium put up in large balls wrapped in a thick case

of poppy leaves, or in cakes wrapped in oiled paper, are not met with in ordinary trade.

Adulterations are mainly of a mechanical character, such as imbedded leaden shot or bullets, pebbles, etc., but gum, starch, extract from poppy plants, etc., have also been used. The assay must determine the quality of any given lot of opium.

Aloe

N. Aloes.—**O.** Obtained from several varieties of *Aloe* (nat. ord.: *Liliaceæ)* by cutting off the leaves, allowing the juice to exude without pressure, and then evaporating to solid consistence.—**H.** As mentioned further on, in connection with different varieties of Aloes.—**D.** Irregular or broken lumps, different shades of brown, opaque in mass, but in thin layers translucent to transparent; fracture more or less distinctly conchoidal, varying from dull waxy to resinous; odor peculiar, reminding of saffron, and taste intensely bitter.—**C.** Aloin varies in quantity in different aloes, from 16 to 25 per cent in Natal aloes, to none at all in Cape aloes; resin 60 per cent in some aloes, trace of volatile oil, etc.—**U.** Active purgative, emmenagogue. Dose: 0.1 to 0.5; for drastic effects, the dose is sometimes increased to 1 gram.

The following are the more important varieties of aloes occurring in the trade:

ALOE SOCOTRINA, Socotrine Aloes; from the Island of Socotra and Eastern Africa; obtained from *A. Perryi;* brought into trade usually in monkey-skins. The interior sometimes still moist, yellowish or orange-brown, not greenish; translucent; odor rather pleasant. Considered the best variety of aloes.

ALOE BARBADENSIS, Barbadoes Aloes; from the Island of Barbadoes; obtained from *A. vera;* brought into trade mainly in gourds. Deep orange-brown; odor peculiar, differing from Socotrine aloes. Considered to be a good variety of aloes. Curaçao aloes, a variety of Barbadoes aloes, gathered and prepared from *A. vera, A. spicata* and other varieties of *Aloe,* in the Dutch West Indies, comes into trade in old boxes and irregular packages. It is said that Barbadoes aloes is no longer to be found in the trade and that Curaçao aloes has displaced it entirely.

ALOE CAPENSIS, Cape Aloes; from Southern Africa, Cape of Good Hope; obtained from *A. ferox* and other varieties of *Aloe;*

comes into trade in boxes or skins. Blackish-brown or olive-black; odor disagreeable. The poorest variety of aloes, used almost exclusively for veterinary purposes.

Kino

N. Kino. The word is indeclinable and neuter.—**O.** The inspissated juice, from incisions in the trunk of *Pterocarpus Marsupium; Leguminosæ.*—**H.** East Indies.—**D.** Small, angular, brittle pieces, glossy, brownish-red in larger fragments, ruby-red and transparent in small splinters or on the edges of the larger fragments; odorless, with sweetish astringent taste, becoming plastic and adherent to the teeth when chewed, and coloring the saliva deep-red.—**C.** Kino-tannic acid, coloring matter, etc.; should be almost completely soluble in alcohol and at least 80 per cent should be dissolved by boiling water. Kino contains pectin, etc., and its solutions, such as tincture, etc., are very apt to gelatinize.—**U.** Pleasant astringent, especially in diarrhœas of children. Dose: 0.5 to 2 grams.

Several varieties occur in the trade, of which the one mentioned above is the best and the most usual; it is known as Malabar Kino.

West Indian Kino, or Jamaica Kino, is from *Coccoloba uvifera; Polygonaceæ;* dark brown-red and almost completely soluble in both alcohol and water.

South American Kino, or Caraccas Kino, is from the same plant as the West Indian variety, but seems to be prepared in a more slovenly manner; it contains more impurities.

African Kino was from a variety of *Pterocarpus,* but is no longer found in the trade.

Australian Kino, or Botany Bay Kino, is from *Eucalyptus resinifera* and other varieties of *Eucalyptus; Myrtaceæ.* It varies in characteristics, is often very much contaminated with impurities, as bits of bark, etc., and is seldom used.

Lactucarium

N. Lactucarium, German Lactucarium.—**O.** The concrete milk-juice of *Lactuca virosa* (nat. ord.; *Compositæ),* obtained by incision and gathered when partially dry or concrete.—**H.** Prepared

in Scotland, England, France and Germany; the variety mainly used in this country is "German" Lactucarium.—**D.** The juice appears to be collected in small saucer-shaped vessels, and when nearly hard is cut into four pieces; this makes the pieces appear as quarters of a saucer-shaped cake, as shown in the illustration; or it may occur in irregular fragments of larger cakes broken up; grayish-brown to dark reddish-brown externally, whitish-gray within, with waxy fracture; odor heavy narcotic, taste bitter.—**C.** Lactucin, caoutchouc, resin, etc. Partly soluble in alcohol and ether; yields nearly half its weight to boiling water, making a deep-brown solution. Diluted alcohol dissolves about 40 per cent of the drug.—**U.** Anodyne, soporific or hypnotic; similar in action

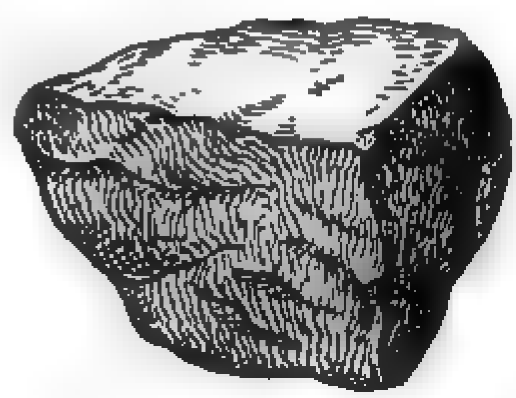


Fig. 460.

to opium, but much less active and reliable. Dose: 0.5 to 1 gram; has been given even up to 4 grams.

See also Lactucarium Gallicum, a little farther on.

Extracts

See remarks and synopsis of group on pages 523 and 524.

Catechu

N. Catechu, Cutch, *Terra Japonica.* The word "catechu" is indeclinable and neuter.—**O.** An extract prepared from the heartwood of *Acacia Catechu; Leguminosæ.*—**H.** East Indies.—**D.** In irregular masses and fragments, dark brown, fracture brittle and glossy when freshly made; often contaminated with fragments of leaves, etc., due to the fact that the inspissated juice is poured on layers or mats of leaves to cool and harden; nearly odorless,

with sweetish and very astringent taste.—**C.** About 35 per cent catechutannic acid; should not yield more than 6 per cent of ash.—**U.** Astringent. Dose: 0.5 to 2 grams.

Catechu pallidum, or Pale Catechu Gambir, is an entirely different article. The word "gambir" is indeclinable and neuter. Gambir is an extract prepared from the leaves and twigs of *Ouroceparia Gambir; Rubiaceæ.*—**H.** Malacca, Sumatra and Cochin China.—**D.** The leaves and small twigs are boiled in water and the decoction is evaporated to solid extract consistence. It comes into trade in irregular lumps or small cubes, about 2.5 cm. in size; reddish-brown externally and lighter colored within with a brittle and dull fracture; odorless, sweetish-bitter and astringent taste.—**C.**, **U.** and dose, as of catechu.

Hæmatoxyli Extractum

N. Logwood Extract.—**O.** Made by evaporating a decoction from chips of the heart-wood of *Hæmatoxylon Campechianum* (nat. ord.; *Leguminosæ)* to dry extract consistence. See also Hæmatoxylon, page 281.—**D.** Brittle, dry cakes of deep ruby-red color, without odor and with sweetish astringent taste. As a trade article or drug, it usually occurs in circular cakes enclosed in paper boxes, prepared by pouring the extract, when sufficiently evaporated to congeal, into the boxes as moulds and letting the extract harden in the boxes.—**C.** Tannic acid and a peculiar coloring principle, hæmatoxylin.—**U.** A mild astringent. Dose: 0.5 to 2 grams. Also used in dyeing textile fabrics.

Glycyrrhizæ Extractum

N. Liquorice Extract, Liquorice, Licorice.—**O.** Made by evaporating a decoction of the roots of *Glycyrrhiza glabra* (nat. ord.: *Leguminosæ)* to dry extract consistence.—**D.** This extract is manufactured in enormous quantities, both at the places where liquorice root is grown, and in this country, most of it being consumed in the manufacture of chewing tobacco. For this purpose it is furnished in casks, boxes, etc., into which the extract is poured and in which it cools and hardens. For the drug-trade the extract is moulded into round sticks, about 1.5 cm. thick and about 15 cm. long, with usually a trade-mark or manufacturer's brand

stamped on one end, which is flattened and broadened thereby. The extract is black, with brittle, glossy, conchoidal fracture; no odor, very sweet taste.—**C.** The sweetness depends on glycyrrhizin.—**U.** Demulcent, expectorant. Mainly used in pharmacy and medicine as an excipient, to disguise the tastes of disagreeable medicines.

Lactucarium Gallicum

N. French Lactucarium, Thridace.—**O.** The juice of the tops of *Lactuca virosa (Compositæ)*, obtained by expression, or an extract obtained in the usual manner by boiling water, inspissated to dry extract consistence.—**D.** Occurs in the trade in thin flat brown cakes, or, as it is hygroscopic, more frequently as a dark-brown pasty mass, like thick solid extracts. Odor slightly narcotic, taste bitterish.—**U.** Similar to those of true lactucarium, but weaker and even less reliable. Used almost exclusively as a cheaper substitute for true lactucarium.

GROUP LXXVII

Sugars

Sugars are sweet to the taste, soluble in water, forming syrups, and soluble in dilute alcohol. It is not necessary to say much about the different kinds of sugars or saccharine principles, because that belongs to chemistry rather than to pharmacognosy; a few words on this subject will therefore suffice.

Cane sugar, Saccharose or Sucrose, from sugar cane, sorghum, sugar beet and sugar maple.

Grape sugar, including dextrose or grape sugar and levulose, or fruit sugar, from grapes and fruit, but commercially, by chemical processes, from starch of corn and cereals;

Mannite, contained in manna;

Maltose, produced by the action of malt on starch; and

Lactose, or milk sugar, from the whey of milk.

In this connection the saccharine substances of animal origin must be remembered, namely sugar of milk (see page 45) and honey (see page 48).

White, hard, crystalline granules; very sweet	**Saccharum.**
Cylindrical crystalline masses; transparent, and very sweet	**Rock Candy.**
Yellowish granules or masses; or thick, viscid, transparent paste; sweet	**Glucose.**
Flattish- yellowish-white, porous flakes; honey-like odor and sweet taste	**Manna.**
Cylindrical crystalline masses; yellowish-white, opaque; sweetish	**Saccharum Lactis.**
Syrupy, sweet, aromatic, sometimes granular liquid	**Mel.**

Saccharum

N. Sugar.—**O.** and **H.** From the cane of *Saccharum officinarum (Graminaceæ),* cultivated in Southern United States, West Indies, Africa, Hawaiian Islands, and other tropical and subtropical countries; from *Sorghum saccharatum* and other varieties of *Sorghum (Graminaceæ),* cultivated in the Northern temperate zone; from the sugar beet, *Beta vulgaris (Chenopodiaceæ),* cultivated in temperate parts of North America and Europe; from the sugar maple, *Acer Saccharinum (Sapindaceæ),* cultivated in Northern United States and Canada. The sugar beet is the most important source of sugar, the sugar cane coming next in importance.—**D.** Sugar, or "granulated sugar," occurs in white dry, hard, crystalline granules, permanent in the air, soluble in one-half its own weight of water; odorless, and with a pure sweet taste.—**U.** Demulcent, lenitive; mainly used for sweetening.

Rock Candy is cane sugar crystallized in large cylindrical or irregular masses, usually around a string or stick; either colorless, or colored pink. It is simply a pure sugar.

Clarified (yellowish) and brown sugars contain small quantities of molasses; they are granular, not crystalline, and very sweet.

Inferior granulated sugar often has a yellowish tint, which is removed or "bleached" by adding ultramarine or Prussian blue to the sugar; sugar whitened thus is apt to cause bluish precipitates in preparations made from it, and chemical syrups are apt to spoil more readily than when pure granulated sugar is employed in making them.

When sugar is crystallized from its solution, a certain proportion of it remains as uncrystallizable sugar in the solution and

this constitutes "syrupus fuscus," molasses, or sugar house molasses.

Crude maple sugar usually comes in round or rectangular cakes, of a yellowish-brown color, with an agreeable aromatic odor and a very sweet, peculiarly pleasant flavor.

Saccharum Uveum

N. Grape Sugar.—**O.** Can be made from grapes or fruits, but is made in a much cheaper manner by boiling starch for some time with dilute sulphuric acid, then neutralizing the acid with calcium carbonate, filtering the solution and evaporating the filtrate.—**D.** Whitish or yellowish masses or granules, inodorous, less sweet than cane sugar. Also furnished in the form of a thick, viscid, paste-like mass, when it is called glucose; also less thick, or as a syrup.—**U.** Same as of cane sugar, for which latter it is often used as a harmless and cheap substitute or as an admixture, especially in the manufacture of candies and confections. Solutions of glucose are more apt to ferment than solutions of cane sugar, and glucose is therefore less fitted for making the pharmaceutical and chemical syrups.

Manna

N. Manna.—**O.** A concrete saccharine exudation from incisions in the stem of *Fraxinus Ornus; Oleaceæ.*—**H.** Mediterranean countries.—**D.** "Flake Manna:" In flattish, somewhat three-edged pieces or "flakes," up to 20 cm. long and 5 cm. broad, although usually much smaller; porous, crystalline, easily broken; yellowish-white externally, white within; odor aromatic, reminding of honey, and taste sweet, slightly bitterish and acrid. In a less valuable variety of manna, the flakes are broken and more or less agglutinated, forming irregular lumps; less white, more yellowish to yellowish-brown; otherwise like flake manna.—**C.** About 90 per cent mannite in the best varieties, glucose, etc.—**U.** Lenitive, demulcent, laxative. Dose: 5 to 25 grams.

"Sorts Manna" or "Manna in Sorts" consists of more or less agglutinated masses, showing tears with crystalline structure, but few fragments of flakes; often brown, and always inferior to flake manna.

A fat, viscid, brownish manna with neither fragments of flakes or tears, and showing no crystalline particles, should be rejected.

GROUP LXXVIII

Gums

In many trees a peculiar change of the cell-wall in the barks takes place under certain circumstances, resulting in the formation of gum. Incisions or accidental injuries to such trees are followed by an exudation of a peculiar material, intended apparently by nature as a means of closing the wound and protecting the tree against injurious influences (from bacteria causing decay) or too great a bleeding or loss of sap.

Gums have an insipid taste, are soluble in water, or swell in water, forming either a liquid mucilage or a jelly-like paste; they are insoluble in alcohol and are precipitated from watery solutions by alcohol.

When a gum, resin, or other substance exudes in round or oval grains or lumps, and these lumps remain separate, they are known as "tears;" if they exude in flat band-like pieces, these pieces are called "flakes."

Gums from various trees, peach, cherry, the mesquite trees of Texas, etc., have been used, but are not regular articles of commerce although they may perhaps be met with as adulterants occasionally. Dextrin, made from starch, is used as a substitute for gum arabic in the manufacture of cheap mucilages for pasting.

In distinct, transparent, crackled, colorless to yellowish tears; soluble in water .... **Acacia.**

In wavy and curved flakes, whitish, translucent; swells in water .... **Tragacantha.**

Acacia

N. Acacia, Gum Arabic.—**O.** A spontaneous exudation from the stems and branches of *Acacia Senegal; Leguminosæ;* probably also from other varieties of *Acacia,* as *A. vera,* etc.—**H.** Africa.—**D.** Roundish, crackled tears, or angular fragments of tears, with a brittle, vitreous, sometimes iridescent fracture;

transparent and nearly colorless in small tears that are not crackled or in thin fragments, but more or less opaque from numerous minute fissures in the larger tears; varying in color from nearly colorless in the best varieties to yellowish or brownish in inferior grades; odorless; taste mucilaginous and insipid.—**C.** About 14 per cent water; arabic acid combined with calcium, magnesium and potassium, sugar, etc. Acacia is soluble in water and forms a mucilage with it; but insoluble in alcohol.—**U.** Demulcent; used for emulsifying and in the arts.

Poorer varieties of acacia are darker colored, almost brown, but all varieties yield a perfectly white powder, which should contain no starch. The faintest sourish odor, when moist breath is blown over it, indicates an inferior gum.

Tragacantha

N. Tragacanth.—**O.** Exudes spontaneously and from incisions in the stem of *Astragalus gummifer* and other varieties of *Astragalus; Leguminosæ.*—**H.** Western Asia.—**D.** *Flake Tragacanth:* In bands or flakes of various sizes and widths, more or less wavy, curved and contorted, marked with parallel lines, white

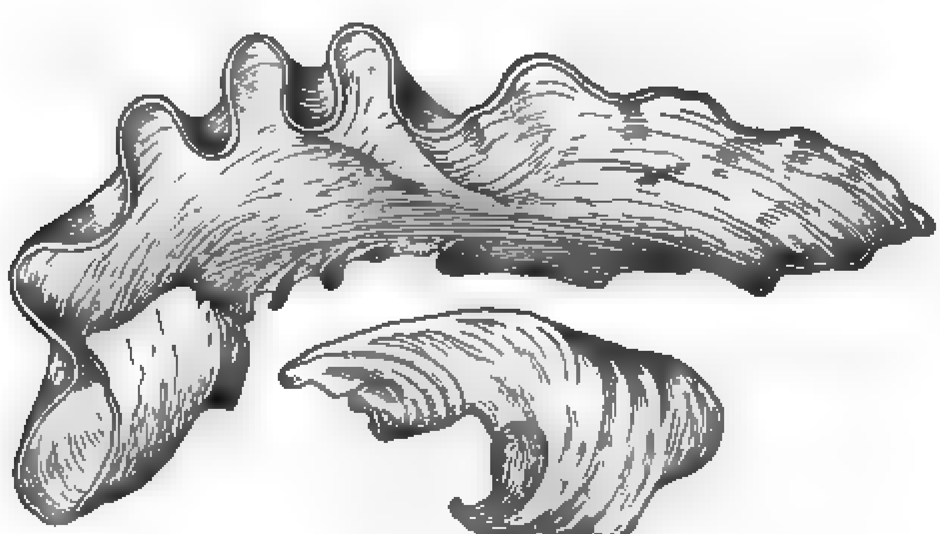


Fig. 461.

or yellowish-white, translucent, horny, tough; odorless and insipid.—**C.** Consists mainly of bassorin, and a compound of gummic acid with calcium that is not identical with that found in Acacia. About one-half of this gum (the bassorin) is insoluble in water, merely swelling into a gelatinous mass or paste.—**U.** Demulcent; used to make pill-masses, pastes, etc.

Tragacanth in sorts consists of irregular, more or less dirty fragments or small tears, often mixed with foreign material, peach or cherry gum, etc.

GROUP LXXIX

Gum Resins

The fluids from which these drugs are formed, exist in the plants as emulsions (milky juices, *latex)* either in intercellular spaces or spurious ducts, or in true ducts having their own walls. They consist of a resinous constituent, soluble in alcohol but not in water, and a mucilaginous substance (gum) soluble in water but not in alcohol; in the plant these constituents are mixed with water, as emulsions. Usually they also contain a little fixed oil, some inorganic substances, etc. After they have once been dried, as in the drugs, it is not always possible to remake the emulsion by mere addition of water and trituration, implying therefore that some chemical changes have or may have taken place during the drying of the latex from which they were formed.

Some authors (Berg and Maisch, for example) have grouped gum-resins according to whether they contain small quantities of volatile oil or not, but the amount of this constituent is not sufficiently large in any of them to be of much importance. Gamboge, scammony and euphorbium contain no volatile oil; the others contain from mere traces to a few per cent of it, according to the age of the drug, losing this constituent in the course of time, unless kept in tight containers; and even then it will gradually become less, probably by the oxidation of the oil into resin.

Deep reddish-yellow or orange-yellow cylindrical solid or hollow pieces, or cakes; bright lemon-yellow when wetted or powdered .... **Cambogia.**

Greenish-black or dark grayish, more or less porous masses.... **Scammonium.**

Irregularly roundish tears, often hollow or enclosing spines or fruit parts; yellowish or yellowish-brown............ **Euphorbium.**

Brownish, slightly sticky mass; containing whitish tears embedded in a pinkish-brown substance; very fetid odor.... **Asafœtida.**

In separate tears, or masses, dirty white to pale brown externally, with bluish-white opalescent fracture; peculiar odor and bitter taste.................................. **Ammoniacum.**

Tears or masses, friable, reddish-brown, with fatty or waxy fracture .... **Myrrha.**

Yellowish translucent tears, generally rough and powdery on the outer surface from attrition......................... **Olibanum.**

Small, whitish to yellowish-brown translucent tears, with peculiar odor and acrid bitter taste...................... **Galbanum**

Cambogia

N. Gamboge, *Gummi Gutti.*—**O.** A gum-resin obtained from *Garcinia Hanburii; Guttiferæ.*—**H.** Southeastern Asia, in Camboja, Annam and Siam.—**D.** The milk-juice exudes from incisions and is gathered in bamboo joints; when sufficiently dry the bamboo is split off and the gamboge is in cylindrical, sometimes tubular pieces (pipe gamboge) 2.5 to 5 cm. in diameter, showing longitudinal impressions or lines of the inner surface of the bamboo; fracture shallow conchoidal, glossy; yields a bright yellow powder and becomes bright lemon-yellow when wetted; no smell, but taste acrid. This is the best variety of gamboge; a somewhat less valuable kind, because more liable to be adulterated, is gamboge in cakes, which, however, corresponds otherwise to the above description.—**C.** 65 to 80 per cent resin (cambogic acid), about 4 per cent wax, 1 per cent ash and the remainder gum; the gum therefore varies inversely as resin is more or less plentiful.—**U.** Active hydragogue cathartic. Dose: 0.05 to 0.1 gram; never given in full dose but only in combination with other remedies.

Scammonium

N. Scammony.—**O.** A resinous exudation obtained from the living roots of *Convolvulus Scammonia; Convolvulaceæ.*—**H.** Western Asia.—**D.** In irregular, angular masses or in circular cakes, externally greenish-black or dark grayish, darker internally and more or less porous, as if it had been frothy when exuding, breaking with an angular resinous fracture; odor somewhat cheese-like and taste slightly acrid.—**C.** From 75 to 95 per cent resin, the balance mainly gum. The medicinal value de-

pends on the resin alone, and as the drug is almost always more or less impure or adulterated, only the resin ought to be employed. Scammony sometimes is found containing less than 25 per cent of resin.—**U.** Hydragogue cathartic. Dose: 0.05 to 0.25 gram.

The *Resina Scammonii* of the Br. P. is a pharmaceutical preparation made by exhausting the scammony root with alcohol and precipitating with water. That of the U. S. P. is a purified scammony, therefore, also a preparation.

Euphorbium

N. Euphorbium.—**O.** A gum-resin obtained by making incisions in the stem of *Euphorbium resinifera; Euphorbiaceæ.*—**H.** Morocco.—**D.** Irregular, conical or round tears or drops, about the size of a pea to the size of a hazelnut, brittle, yellowish or yellowish-brown, internally lighter-colored, opaque or slightly translucent; nearly odorless, taste very acrid. The powder is a violent sternutatory.—**C.** About 38 per cent resin, 22 per cent euphorbon, 18 per cent gum, etc.—**U.** A drastic emetico-cathartic, but not used internally. The acrid resin renders plasters made from euphorbium rubefacient and vesicant.

Asafœtida

N. Asafetida.—**O.** A gum-resin obtained from the living roots of *Ferula Asafœtida* and *Ferula fœtida (Narthex Asafœtida); Umbelliferæ.* Probably also from other varieties of *Ferula.*—**H.** Afghanistan, Persia, Thibet and countries on the Arabian Sea.—**D.** The finest asafetida is in irregular firm masses, neither hard and dry, nor soft and sticky; externally yellowish-gray to brownish-gray, internally milk-white when first broken but changing gradually to yellow, pink, purplish-red or brown, and showing tears imbedded in the mass, the tears undergoing the color changes slower than the mass in which they are imbedded; should be free from admixture of bark and other foreign impurities; odor very disagreeably fetid (wherefore it is called *Teufelsdreck* in German, or *Stercus Diaboli* in older pharmacy), and taste bitter.—**C.** From 3 to 9 per cent volatile oil, 20 to 30 per cent of gum, and 50 to 70 per cent of resin; not less than 50 per cent should be dissolved in alcohol, and the ash should not

exceed 10 per cent; when triturated with water it yields a white emulsion.—**U.** Nervine, antispasmodic and carminative; an ingredient of most table sauces. Dose: 0.2 to 1 gram.

Asafetida in tears is best, but scarce. Asafetida in masses is most plentiful, the better kind often consisting mainly of whitish tears, imbedded in or agglutinated by a comparatively small amount of the somewhat softer pinkish-brown substance. This is the kind described above.

Dry, hard, dark brown, dirty or sticky asafetida, as well as one which shows a brown color in the fresh fracture, should be rejected.

Ammoniacum

N. Ammoniac.—**O.** A spontaneous exudation from the stem and root of *Dorema Ammoniacum,* and probably also other species of *Dorema; Umbelliferæ.*—**H.** Persia and Turkestan.—**D.** In roundish or irregularly globular tears, from 2 to 6 mm. or more in diameter, sometimes agglutinated into small masses, pale yellowish-brown externally, breaking with a conchoidal fracture, and on being freshly broken bluish-milkwhite and opalescent within; hard at ordinary temperature, but softening by the warmth of the hand; odor peculiar, balsamic, and taste bitter, nauseous and acrid.—**C.** A small amount of volatile oil, 60 to 70 per cent resin, about 20 per cent gum, etc. When triturated with water it yields a white emulsion.—**U.** Antispasmodic and blennorrhetic, resembling asafetida in action. Dose: 0.5 to 2 grams.

Ammoniac deteriorates with age, and dark colored gum-resin with but a faint odor should be rejected.

Cake ammoniac is a variety of ammoniac that exudes spontaneously (or from the stings of insects) from the roots of the plant, and usually contains vegetable impurities, sand, earth, and tears of ammoniac, agglutinated into a brown mass; it should not be used for medicinal purposes.

Myrrha

N. Myrrh.—**O.** A gum-resin obtained by spontaneous exudation from the bark of *Commiphora (Balsamodendron) Myrrha; Burseraceæ.*—**H.** Eastern Africa and Southwestern Arabia.—**D.** Roundish translucent, friable, reddish-brown tears or irregular

masses, very variable in size, rough and powdery on the outer surface (from attrition) with waxy or fatty fracture, sometimes marked with whitish veins; balsamic odor and bitter, acrid taste.—**C.** 2 to 4 per cent volatile oil, 25 to 45 per cent resin and 40 to 60 per cent gum, etc. When triturated with water, myrrh yields a brownish-yellow emulsion.—**U.** Tonic, blennorrhetic, expectorant and emmenagogue. Dose: 0.25 to 2 grams.

Clean, semitransparent pieces ought always to be selected for medicinal use, and dark, opaque pieces should be rejected.

Olibanum

N. Olibanum, Incense, Frankincense, Thus.—**O.** An exudation from the bark of *Boswellia Carterii* and other varieties of *Boswellia; Terebiuthaceæ.*—**H.** Eastern Africa and Arabia.—**D.** Round or oblong tears of various sizes, but generally averaging about 15 mm. in length, covered with a whitish dust formed by the attrition of the pieces, hard, brittle, with waxy fracture, pale reddish-yellow, translucent; when masticated it softens and forms a whitish emulsion with the saliva; odor balsamic and taste bitterish.—**C.** 4 to 7 per cent volatile oil, 50 to 70 per cent resin, 30 to 40 per cent gum, etc.—**U.** Stimulant blennorrhetic. Dose: 1 to 5 grams. Mainly used in plasters, fumigating pastilles or in incense for church use.

Galbanum

N. Galbanum.—**O.** A gum-resin which exudes spontaneously from the lower part of the stem of *Ferula galbaniflua,* and probably other varieties of Ferula; *Umbelliferæ.*—**H.** Persia.—**D.** In separate tears from the size of a pin's head to that of a pea, but more commonly more or less agglutinated into lumps; light yellowish to greenish-brown externally, internally paler in color, but rarely whitish; softens from the warmth of the hand; odor very peculiar, strong, balsamic, and taste bitter and acrid.—**C.** 6 to 9 per cent volatile oil, 60 to 65 per cent resin, 15 to 20 per cent gum, etc. When triturated with water it yields a whitish emulsion.—**U.** Stimulant blennorrhetic. Dose: 0.5 to 1 gram. Mainly used externally in plasters; irritant and suppurative; or as an ingredient of incense used for religious purposes.

GROUP LXXX

Resins

Authors are not agreed on the proper methods of grouping resins, oleo-resins and balsams, or in their definitions of what these substances are. For instance, what we shall call oleo-resins are called "balsams" by Berg; substances which we shall call "balsams" are included in "resins" by Berg and Maisch; we will therefore define what we mean by these several groups in the introductory description of each group, but must consider the general facts now, so that we may understand the relation of these various substances to each other.

It is probable that in the vast majority of all plants a substance is formed which is of the nature of what is generally called a "volatile oil;" while this name is not strictly correct or scientific, none of the terms suggested as substitutes for it have ever met with popular acceptance. Volatile oils are odorous volatile liquids, which cause greasy stains upon paper, resembling those produced by fixed oils, but differing from the latter by disappearing when the stained paper is heated, or spontaneously in the course of time. They are freely soluble in or miscible with alcohol, ether, chloroform, benzin, benzol, fixed oils and bisulphide of carbon, but only to a very limited extent in water. Most of them exist ready formed in the plants, but some few, as oil of mustard and oil of bitter almond, are produced by peculiar fermentative processes of certain plant-elements in presence of water.

Volatile oils are usually obtained from their plant sources by distillation, but sometimes, as in the case of orange and lemon oils, by mechanical methods.

These oils may undergo a peculiar change, termed resinification, either while still in the plant-cells, living or dead, or after they have been separated, in their containers. The resin which is formed during this change (oxidation) may remain in solution in the unchanged volatile oil, when the mixture of the two constitutes an oleo-resin; this fluid solution of resin in volatile oil may be obtained by making incisions, etc., in the plant, and may come into trade as oleo-resin (also called "terebinthia" or "turpentine") as in the case of copaiba or Canada turpentine; or it

may exude spontaneously and the volatile oil may then evaporate, leaving the resin alone as a solid exudation on the outer surface of the stem or other part of the plant; or the resin may be deposited in the cells of the plant (often in special cells or containers, which are termed "resin-ducts," "resin-cells," etc.), in which case they may be obtained for trade by heating the wood or other plant-part which contains the resin, or by dissolving out with some solvent and then evaporating the solvent; or by precipitating the solution of resin in alcohol or other solvent by pouring into water, decanting after settling and recovering the solvent by distillation from the water.

The oleo-resin existing in the plant may also contain benzoic, cinnamic or similar aromatic acids, and whether gathered in the liquid form, as an oleo-resin containing these balsamic acids, or as resins with the volatile oil evaporated, the result is a "balsam;" the characteristic which makes it a balsam being the presence of the balsamic acid or acids, not the presence or absence of the volatile oil.

To come now to the consideration of this group, the resins. Resins are solid substances, fusible at a comparatively low heat, decomposable at a high heat, combustible, burning with a sooty flame, insoluble in water, soluble in the same solvents as volatile oils, while some are also soluble (saponifiable) in alkaline liquids and ammonia.

The latter kind of resins act chemically as acids and are termed resin-acids. Most resins consist of a mixture of resins which can be separated and which have different chemical properties; in such cases they are distinguished by prefixing Greek names of letters, thus "alpha-resin," "beta-resin," etc., those having the most active behavior as acids being designated by the first letters.

Some of the commercial resins retain insignificant quantities of volatile oil, or contain traces of a balsamic acid, as occasionally in dragon's blood, but not enough of either constituent to make them either oleo-resins or balsams.

The following resins exude from plants, either spontaneously or in consequence of incisions, punctures by insects or other injuries: Mastic, sandarac, dammar, copal, dragon's blood, and occasionally guaiac resin; lac is a mixture of exuded resin and

imbedded insects, amber is a fossil resin; rosin is a residue from the distillation of a volatile oil from an oleo-resin; and guaiac resin is often prepared by melting the resin from the heart-wood by fire. Only a few of these drugs are of any importance as medicinal agents; most of them are only used in the arts, for making varnishes, etc.

Roundish, pale yellowish, transparent, brittle tears; becoming plastic when chewed............................**Mastiche.**
Elongated, pale yellowish, transparent tears; crumbling when chewed ....**Sandaraca.**
Roundish, yellowish or straw-colored transparent masses; harder than rosin....................................**Dammara.**
Irregular spherical or angular, yellowish to brownish pieces; transparent; hard ....**Copal.**
Brittle, dark reddish-brown, opaque lumps................**Resina Draconis.**
Brittle, dark reddish-brown sticks; often wrapped in palm leaves ....**Resina Draconis.**
Irregular brittle masses, or large tears; greenish-brown to reddish-brown ....**Guaiaci Resina.**
Small twigs surrounded by a brown-red resinous substance..**Lacca.**
Thin, brittle, brown or reddish-brown scales..............**Lacca.**
Roundish or flat, pale yellowish to brownish-red pieces; dull exterior, glossy transparent within...................**Succinum.**
Yellowish or brownish, transparent, brittle masses........**Resina.**

Mastiche

N. Mastic.—**O.** A concrete resinous exudation, obtained by incisions in the stem of the male plant of *Pistacia Lentiscus; Anacardiaceæ.*—**H.** Greek archipelago, Island of Chios, and other Mediterranean countries.—**D.** Globular or elongated tears, about the size of peas, covered with a whitish dust (from attrition), pale yellowish, transparent, with vitreous fracture; brittle, but becomes plastic when chewed (differentiation from sandarac); balsamic odor, especially when warmed, and a mild terebinthinate taste.—**C.** Trace of volatile oil, 80 to 90 per cent alpha-resin, soluble in cold alcohol, 10 per cent soft, sticky beta-resin, insoluble in cold alcohol; mastic is completely soluble in ether, but only partially soluble in alcohol.—**U.** Mild stimulant, but used almost exclusively for temporarily filling teeth, making varnishes, etc.

Mastic in sorts consists of tears that are gathered from the ground after having dropped from the stem of the tree; it is a mixture of tears, often agglutinated and mixed with bits of bark, sand, earth, etc.

Mastic is sometimes adulterated with sandarac; the tears of the latter are of about the same appearance, but more elongated, and they crumble when chewed.

Sandaraca

N. Sandarac.—**O.** A spontaneous, concrete, resinous exudation from the stems and branches of *Callitris quadrivalvis; Coniferæ.*—**H.** Northwestern Africa (the whole of Barbary).—**D.** Elongated, hard, brittle tears, about 5 to 15 mm. long, covered with a whitish dust (from attrition), pale yellowish, transparent, with vitreous fracture; crumbles when chewed (differentiation from mastic); odor and taste slightly terebinthinate and balsamic.—**C.** Three resins, differing in solubility; soluble in ether and hot alcohol, partly soluble in volatile oils and chloroform.—**U.** Mainly for fine varnishes.

Dammara

N. Dammar.—**O.** and **H.** A spontaneous concrete exudation from *Agathis Dammara*, a tree of the East Indian islands, and *Agathis australis*, a tree of New Zealand; *Coniferæ.*—**D.** Transparent colorless to straw-colored roundish masses, with vitreous conchoidal fracture; softer than copal, but considerably harder than rosin; nearly odorless and tasteless. "Kauri gum," the New Zealand variety of dammar, is often in large lumps; it also often has a faint greenish tint.—**C.** Several resins, of which one constituting about 60 per cent of the drug is soluble in alcohol.—**U.** Used exclusively for making varnishes.

Copal

N. Copal; the word is indeclinable and neuter.—**O.** A spontaneous, concrete resinous exudation from several varieties of *Trachylobium, Hymenæa* and *Guibourtia; Leguminosæ.*—**H.** Africa, West Indies and South America.—**D.** Irregular, spherical, flat or angular pieces, almost as hard as amber, transparent or trans-

lucent, varying from almost colorless or pale yellowish, to yellowish-brown and reddish-brown; with vitreous conchoidal fracture; becomes changed or decomposed by melting; odorless and tasteless.—**C.** Several resins of different solubilities, but all not readily soluble in cold alcohol or oil of turpentine.—**U.** For making varnishes.

Some authors state that copal is also found in a fossil state; Maisch, for instance, says this of both copal and Kauri gum, or New Zealand dammar, which latter resin is occasionally sold as copal. Berg, however, gives very weighty reasons for doubting that copal ever occurs as a fossil substance.

Resina Draconis

N. *Sanguis Draconis*, Dragon's Blood.—**O.** A spontaneous resinous exudation from the fruits of *Daemonorops (Calamus) Draco* or other species of *Daemonorops; Palmaceæ*.—**H.** Borneo, Sumatra, and other East Indian islands.—**D.** Occurs in the drug trade usually in dark, brownish-red, opaque sticks, about 1.5 cm. thick and up to 30 cm. long, wrapped in palm-leaf and tied with thin strips of cane, or fibers of bast; the fracture is dull, irregular, and somewhat brighter colored than the external surface. It also occurs in cakes, or irregular lumps, of the same general appearance as that in sticks, but apt to be mixed with impurities. The best variety is in tears, varying in size from that of a pea to that of a hazelnut, or even up to that of a walnut; usually covered with a red dust (from attrition), and gives a deep-red mark on paper. This variety is not often met with. Odorless and nearly tasteless.—**C.** About 90 per cent of a red acid resin, 2 per cent fatty matter, 5 per cent mineral substances, etc., with occasionally traces of benzoic or cinnamic acid (?); it is almost completely soluble in alcohol, chloroform, benzol and alkalies.—**U.** Mild stimulant, occasionally used in plasters. Mainly used for making varnishes and lacquers.

Similar substances were formerly obtained from *Dracæna Draco* in the Canary islands; from *Pterocarpus Draco* in the West Indies; *Dracæna schizantha*, in the island of Socotra; from *Croton Draco* in Mexico, and from other sources, but only the above described article from the East Indian islands is now to be found in the trade.

Guaiaci Resina

N. Guaiac Resin.—**O.** A concrete resinous exudation, obtained spontaneously or by making incisions in the bark of the stem of *Guaiacum officinale; Zygophyllaceæ.* Or the resin is melted out of the heart-wood of this plant by means of fire, or by boiling shavings of the wood in salt brine and skimming off the resin as it rises to the surface.—**H.** West Indies and Northern parts of South America.—**D.** 1. In roundish or ovate tears, 1 to 2.5 cm. in diameter, covered externally with a greenish dust (from attrition), internally transparent, greenish or reddish-brown, breaking with a glossy conchoidal fracture; softens by the heat of the hand, but becomes tough when chewed; odor feebly aromatic, reminding of vanilla, taste somewhat acrid. 2. In irregular brittle masses, formed by the agglutination of smaller lumps or tears, also generally with a greenish dust on the outer surface, with a vitreous fracture, but transparent only at the edges or in thin pieces or splinters; otherwise with the characteristics of guaiac resin in tears.—**C.** About 15 to 30 per cent impurities, consisting of fragments of bark, etc.; about 80 per cent resin, consisting of a small quantity of guaiacic acid and several resins (alpha-resin, beta-resin, etc.); guaiacol, and other constituents. Soluble in alkalies, alcohol, acetone, ether and chloroform; the alcoholic solution is colored blue on the addition of oxidating agents, ozone, ferric chloride, chlorine, chromic acid, etc.—**U.** Diaphoretic, diuretic, alterative, stimulant. Dose: 0.5 to 1 gram three times a day.

Lacca

N. Lac, Shellac.—**O.** A peculiar resinous substance, consisting of resins exuded from various plants in consequence of the stings from the female insects of *Coccus Lacca; Hemiptera.* As the resins exude they are formed into cell-like structures, mixed with certain excretions and coloring matters from the insects which live in these cells. The best and most highly colored lacs inclose the dead insects. The plant from which lac is mainly produced is *Aleurites laccifera (Euphorbiaceæ),* but also from other trees belonging to various families.—**H.** East India and East Indian islands.—**D.** Lac occurs in the trade in several forms, so that the different varieties must be separately described.

1. Stick-lac. The original form in which the drug is obtained. After the exudation has been formed as above described, the small branches die; the female insects also die after each having deposited 20 to 30 ova in its cell; the encrusted twigs are gathered before the eggs have developed into insects, as in the latter case the young insects consume the red substance of the dead mother insects, thus decreasing the value of the lac. Stick-lac consists of these twigs surrounded by the reddish-brown resinous exudation.

2. Seed-lac. In irregular grains and fragments, consisting of the lac as above described, but separated from the twigs.

3. Lump-lac. Stick-lac melted into lumps, after having been deprived of its coloring matter.

4. Shellac. Same as the last except that the lac is poured out, while melted, on large leaves, quickly covered with another leaf and pressed into thin shell-like tablets or scales. This is the variety that is mainly used by druggists. Thin, glossy, transparent or translucent yellowish to dark brown fragments or scales; brittle and pulverizable; odorless and tasteless.

C. Coloring matter (lac dye) about 4 per cent; about 50 per cent *alpha-resin,* soluble in alcohol and ether, brown, and melting readily; *beta-resin,* soluble in alcohol but not in ether, hard; *gamma-resin,* melting readily, crystallizable, uniting readily with bases; *delta-resin,* soft, readily fusible, very soluble in alkalies, alcohol and ether; and *epsilon-resin,* insoluble in cold alcohol, ether and alkalies, softens in boiling water, but melts only at higher temperatures and is decomposed thereby. The enumeration of these resins is made to illustrate the method of using the Greek letter-names and not because these 5 resins are of any special importance.—**U.** Lac is used as a dye; the resin, exhausted of its coloring matters, is used for sealing wax, varnishes, etc.

Succinum

N. Amber (the ancient "electron").—**O.** A fossil exudation from extinct varieties of coniferous trees, especially from *Pinites succinifer (Picea succinifera); Coniferæ.*—**H.** It is found in soft-coal beds in Prussia, but has been found in other European countries: Sweden, England, Holland, Germany, Poland, France, Italy and Spain; also in Asia, in Siberia, and in North America and

Greenland. The important commercial source, however, is probably a coal-formation under the Baltic Sea, as the amber is found washed up by the waves on the southern coast of this sea, especially after storms; it is also dug out of the sands of the beach, where it has accumulated in the course of ages.—**D.** Roundish or flat pieces, the outside usually worn and dull but capable of receiving a high polish, hard, brittle, with a vitreous conchoidal fracture, colorless or pale yellow ("amber-colored") to reddish-brown, and varying from brilliant transparency through all grades of translucency to opacity; inodorous and tasteless, but gives off fragrant vapors when heated.—**C.** Succinic acid, traces of volatile oil and several resins. The "oil of amber" used in pharmacy is not a constituent of amber, but is a product of the destructive distillation of this drug.—**U.** Mainly used in the arts; the waste chips and raspings resulting from the making of beads, jewelry, ornaments, mouth pieces for pipes, etc., and the inferior opaque and dirty pieces are used for fumigation, for making succinic acid and oil of amber, and for making varnishes.

Resina

N. *Resina Pini,* Resin, Rosin, Colophony.—**O.** Obtained as a residue in the distillation of oil of turpentine from the oleoresinous exudation which is obtained by incisions in the stems of *Pinus palustris* and other varieties of *Pinus; Coniferæ.*—**H.** United States. In Europe a similar substance is obtained from various pine, larch and spruce trees.—**D.** After oil of turpentine has been obtained from common turpentine, the residue which remains in the still is rosin; this, while still hot, is drawn off into rough barrels, where it hardens. For use it is broken into fragments, by chopping off the staves of the barrel and breaking up the mass within. It then forms brittle, amber-colored transparent masses, angular, with conchoidal resinous or vitreous fracture; it melts readily; odor and taste slightly terebinthinate.—**C.** The anhydrid of abietic acid, convertible into abietic acid by dilute alcohol; resin is soluble in alcohol, ether, volatile oils, fixed oils and fats, chloroform, benzol, glacial acetic acid and alkalies.—**U.** Mild stimulant, used in ointments and plasters; also in making soaps, wagon or axle grease, etc.

The lightest colored and most transparent rosin is most highly esteemed, and darker colored and less clear rosin is considered inferior.

GROUP LXXXI

Oleo-Resins

For a description of the nature of the drugs of this group see the introductory remarks for Group LXXX. Oleo-resins vary from fluids to soft or plastic solids. The word "balsam" is sometimes, but erroneously, the author thinks, applied to oleo-resins: its use should be confined to oleo-resins or resins containing balsamic acids.

Transparent, more or less viscid liquid; yellowish-brown; peculiar odor and bitter acrid taste..	**Copaiba.**
Tough, plastic, nearly solid yellowish mass; terebinthinate odor and taste..................	**Terebinthina.**
Soft yellowish mass, granular within; odor fennel-like and taste terebinthinate................	**Elemi.**
Thick viscid, clear, transparent, pale yellowish liquid; odor terebinthinate..................	**Terebinthina Canadensis.**
Thick viscid liquid, similar to last, but turbid....	**Terebinthina Veneta.**
Yellowish-brown opaque mass; plastic by warmth of hand, brittle when cold; conchoidal translucent fracture	**Pix Burgundica.**
Dark reddish-brown opaque mass; brittle when cold; fracture resinous, translucent, conchoidal	**Pix Canadensis.**
Thick, sticky, viscid, blackish-brown liquid; empyreumatic terebinthinate odor.............	**Pix Liquida.**

Copaiba

N. Copaiba, Copaiva; often, but erroneously, called Balsam Copaiva.—**O.** An oleo-resin obtained by incising or boring into the stems of *Copaifera Langsdorfii* and other varieties of *Copaifera Copaiba*; *Leguminosae*.—**H.** Brazil, and along the Orinoco river in Venezuela and Northern part of South America.—**D.** A transparent or translucent, more or less viscid liquid; yellowish to yellowish-brown color; peculiar aromatic odor and bitter acrid taste.—**C.** About 45 to 55 per cent volatile oil, but sometimes much more, sometimes less, about 50 per cent hard alpha-resin, the proportion

varying inversely as the amount of volatile oil varies; about 1½ per cent sticky beta-resin, etc. Copaiva is soluble in alcohol, ether, chloroform, benzin, volatile and fixed oil, etc.; remains transparent when shaken with one-third of its volume of ammonia water, and it solidifies with about one-sixteenth of its weight of magnesia.—**U.** Stimulant blennorrhetic, diuretic, diaphoretic and expectorant. Dose: 0.5 to 3 or 4 grams.

Para Copaiva is best; light colored, transparent, and contains from 50 to 90 per cent volatile oil.

Maracaiba Copaiva is darker colored, sometimes turbid, contains from 25 to 50 per cent volatile oil, and solidifies more readily with magnesia.

Terebinthina

N. Turpentine.—**O.** An oleo-resinous exudation from the stems of *Pinus palustris* and other varieties of *Pinus; Coniferæ.* It exudes spontaneously but is mostly collected in hollows or "boxes" cut into the sap-wood of the tree.—**H.** United States. In Europe a similar substance is obtained from various pine, larch and spruce trees.—**D.** Rarely comes into trade as the liquid which it is when it exudes from the trees; as found in the trade some of the volatile oil has been lost or has resinified, and turpentine then is in a yellowish plastic opaque mass; becomes solid in the cold so that it can be broken with a granular fracture, as if it contained small quantities of water; odor peculiar (gives rise to the term "terebinthinate") and taste bitter and acrid.—**C.** 20 to 30 per cent volatile oil, which, when separated by distillation constitutes the oil of turpentine or "spirits turpentine" of trade; the anhydrid of abietic acid, other resins, traces of succinic acid, etc. See also *Resina,* Group LXXX.—**U.** Not employed internally, but only in plasters, etc.

Elemi

N. Elemi; the word is indeclinable and neuter.—**O.** The source of this drug, as it now occurs in trade, is not positively known, but it is probably derived from *Canarium commune (Burseraceæ),* from the stem of which it is derived by making incisions. But it is probably also derived from other trees.—**H.** Philippine Islands, Mexico and Brazil.—**D.** A yellowish, resinous mass resembling

solidified granular honey in consistence; when old it becomes harder, and even friable; color variable, greenish-white, to yellowish, with occasionally brownish tint; odor strong, suggesting a mixture of oil of turpentine, oil of fennel and oil of lemon, and the taste is pungent and bitter.—**C.** About 10 per cent volatile oil, 60 per cent amorphous resin, 25 per cent crystallizable resin, etc.—**U.** Stimulant, irritant. Used only in plasters.

Terebinthina Canadensis

N. Canada Turpentine, Canada Balsam, Balsam of Fir.—**O.** Obtained by puncturing the vesicles which form on the bark of *Abies balsamea; Coniferæ.*—**H.** Canada and Northern United States.—**D.** A perfectly clear transparent liquid, of about the consistence of honey, viscid, pale yellowish with sometimes a faint greenish tint; odor pleasantly terebinthinate and taste bitterish acrid.—**C.** About 25 to 30 per cent volatile oil, the balance being mainly resin, or several resins. When exposed to air, the oil gradually disappears leaving a hard and perfectly clear mass; soluble in ether, chloroform and benzol, and partly soluble in alcohol.—**U.** Medicinally it is seldom used, although it is a stimulant blennorrhetic. It is mainly employed in making fine photographic varnishes, for mounting microscopic preparations, etc.

A very similar turpentine is obtained from *Abies Menziesii,* which is called **Oregon Balsam of Fir.** It resembles Canada turpentine, but becomes opaque and granular with age. I have made hundreds of lantern slides, which were painted with transparent oil paints and then sealed with solidified Canada turpentine. Most of these are beautifully clear, although some of them were made more than thirty years ago. But quite a number made in exactly the same way, and sealed with the resin obtained from a certain lot of balsam, have gradually become opaque from the formation of stellate clusters of crystals, and it is possible that they were sealed with Oregon balsam of fir. I regret that I cannot tell how to distinguish this from the true Canada turpentine, as such knowledge would save many slides and microscopic preparations from being ruined. Reliable wholesale houses can probably give assurance on this point by knowing from which region they have obtained the article.

Venice Turpentine is also similar to Canada turpentine, but is

always slightly turbid. It is obtained by boring holes in the stem of *Larix Europæa (Coniferæ)*; these holes are closed with plugs, and every few days the accumulated oleo-resin is drawn off into bottles. It is darker colored, usually with a pronounced greenish tint, and always less transparaent than Canada turpentine.

Pix Burgundica

N. Burgundy Pitch.—**O.** A purified oleo-resin, obtained from the oleo-resin of *Picea (Abies) excelsa* and *Pinus pinaster (Pinus Abies)*, both belonging to the natural order *Coniferæ*; the oleo-resin exudes spontaneously and after being gathered is melted, water being occasionally added; it is then strained, and the process of repeatedly melting with added water and straining, finally removes all impurities and nearly all of the volatile oil, so that Burgundy pitch is almost reduced to mere resin; in fact, Berg enumerates it among the group of resins.—**H.** In mountainous regions in Southern Europe.—**D.** Dull yellowish or reddish-brown, opaque or slightly translucent mass; hard, friable, breaking with a vitreous conchoidal fracture, even brittle when cold and yet plastic enough to gradually run together into one mass and to acquire the shape of the vessel in which it is kept, and to assume a level surface as a liquid would; aromatic odor, taste terebinthinate but not bitter.—**C.** Volatile oil in varying proportions, water, and resin.—**U.** Stimulant, irritant, used only in plasters.

Pix Canadensis, or Canada Pitch, Hemlock Pitch, sometimes erroneously called Hemlock Gum, is obtained from the bark of aged and decaying trees of *Tsuga (Abies* or *Pinus) Canadensis; Coniferæ*. The bark is stripped off the trees, broken in small pieces and boiled in water, the adherent oleo-resin rises to the top and is skimmed off, purified by a second boiling in water, again strained and allowed to separate from the water and harden. It is hard, brittle, yet quite plastic, dark reddish-brown, almost odorless and tasteless, and is used precisely like Burgundy pitch.

Pix Liquida

N. Tar, Pine Tar (as distinguished from coal-tar).—**O.** An empyreumatic oleo-resin obtained by destructive distillation from the wood of different varieties of *Pinus; Coniferæ*.—**H.** Unite

States. Similar products are also prepared in Europe, but the native article supplies our trade.—**D.** A thick, viscid, sticky, blackish-brown liquid, opaque in bulk, transparent in thin layers; becomes thicker, granular and more opaque; odor strongly empyreumatic and terebinthinate, taste acrid empyreumatic and bitterish.—**C.** The composition is variable. Tar contains a volatile oil, crude acetic (pyroligneous) acid, pyrocatechin, acetone, phenols, creosote, etc. Tar is insoluble in water, but imparts to it a small proportion of its constituents; it sinks in water. It is soluble in alcohol, ether, chloroform, volatile oils, fixed oils and fats, and in solutions of potassa and soda.—**U.** Stimulant blennorrhetic in doses of 0.03 to 1 gram; externally in ointments, plasters, etc., when it acts as an irritant and parasiticide.

North Carolina and Swedish tars are esteemed as best.

Birch tar is a similar substance, made from the wood of *Betula alba; Cupuliferæ.* It contains a large proportion of pyrocatechin, and is esteemed on account of its peculiar odor which is well known as the odor of Russia leather.

Beech tar is made from the wood of *Fagus Sylvatica (Cupuliferæ)* and is generally considered as the best source for obtaining creosote for internal use.

Juniper tar, oil of cade or *Oleum Cadinum,* is derived from the wood of *Juniperus oxycedrus; Coniferæ.* It is more liquid than pine tar and has a somewhat different odor.

GROUP LXXXII

Balsams

As already explained in the introductory remarks to Group LXXX, balsams are either resins or oleo-resins in combination with balsamic acids—with either one or more of benzoic, cinnamic or other analogous acids, for instance. It is true that this is not the universally accepted definition for "balsam," and that the word balsam is used by some authors, Maisch, for instance, for oleo-resins with balsamic acids and by Berg for oleo-resins with and without balsamic acids (thus making the word synonymous with oleo-resin), and in both cases making the presence of

the volatile oil the characteristic of a balsam. If it is desirable to distinguish between oleo-resin and balsam, as Maisch does, and if the presence or absence of aromatic or balsamic acids is made the basis of such differentiation, then every argument would apply equally as strongly in favor of differentiating between resins with and resins without balsamic acids; and if the presence of these acids in oleo-resins is held to constitute the characteristics of "balsams," then the presence of the acids is the important feature and not the presence of the oil, and therefore a resin containing these acids should be called a balsam also. This is done in the classification used in this book. No important practical gain is achieved by making distinction between the two kinds of balsam, and we therefore make none.

A solid brown mass with whitish tears imbedded in it; strong balsamic odor........................**Benzoinum.**
Nearly solid yellowish-brown substance of uniform consistence; strong balsamic odor..............**Balsamum Tolutanum.**
A thick, syrupy, brownish-black liquid; somewhat smoky balsamic odor..........................**Balsamum Peruvianum.**
Thick, viscid, gray, opaque, semi-solid substance; with agreeable balsamic odor..................**Styrax.**
Thick, brownish-yellow, clear liquid, or almost solid substance; odor balsamic......................**Liquidambar.**

Benzoinum

N. Benzoin.—**O.** A resinous balsam obtained by making incisions in the stem of *Styrax Benzoin* and other species of *Styrax; Styraceæ.*—**H.** Sumatra, Java and Siam.—**D.** Lumps or irregular masses of a yellowish-brown resinous substance in which tears are imbedded which are milk-white within; gives off fumes of benzoic acid when heated; odor agreeably balsamic, taste aromatic but somewhat acrid.—**C.** 12 to 20 per cent benzoic acid, about 80 per cent resins, some cinnamic acid, vanillin, etc. Benzoic acid is obtained from benzoin by sublimation, but it is also obtained from other sources, and especially synthetically from hippuric acid (the urine of horses and cows); this latter is called "German" benzoic acid.—**U.** Stimulant blennorrhetic, expectorant. Dose: 0.5 to 2 grams. Also for tooth-washes, cosmetics, etc.; mainly for making benzoic acid.

There are three principal kinds of benzoin:

Siam Benzoin in tears, consisting of separate tears, about 2.5 cm. in diameter, externally pale reddish-brown, internally waxy and milk-white; in small fragments translucent; very agreeable vanilla-like odor. This is the best variety of benzoin.

Siam benzoin in masses, composed mainly of tears, as just described, but agglutinated and held in solid masses by a reddish-brown or brick-red resin.

Both kinds of Siam benzoin dissolve almost entirely in moderately warm alcohol.

Sumatra or *Penang benzoin* is in grayish-brown to chocolate-colored masses, without any distinct tears; odor agreeable but fainter than that of Siam benzoin. It contains about 10 per cent cinnamic acid and correspondingly less benzoic acid; also pieces of bark, etc.

Balsamum Tolutanum

N. Tolu Balsam, Tolu, Balsam of Tolu.—**O.** A balsam which is obtained by making deep V-shaped incisions in the bark of *Myroxylon toluifera; Leguminosæ.*—**H.** Venezuela and New Granada.—**D.** A light brown, slow-flowing resin, soft enough to yield to the pressure of the finger, but not viscid or sticky; assumes the shape of the container and attains a level surface; in cold weather it becomes brittle; odor very agreeably aromatic, taste aromatic, not acrid.—**C.** About 1 per cent volatile oil (tolene), cinnamic acid (but little benzoic acid), benzoate and cinnamate of benzyl, one resin readily soluble in alcohol and one resin not soluble in alcohol, etc.—**U.** Mildly expectorant, but only used for flavoring purposes, in syrup, as an ingredient of chewing gums, etc.

Balsamum Peruvianum.

N. Balsam of Peru.—**O.** A balsam, obtained from *Toluifera Balsamum (Myroxylon Pereira); Leguminosæ.* It is obtained by first beating the bark of the tree with the back of an axe, leaving strips of sound bark between the parts bruised; the bruised bark is charred with torches five or six days afterwards and a week or so later it can be readily removed or falls off; the bare wood is then covered with rags which absorb the exuding balsam, and when saturated these rags are taken off, gently boiled in water in which the balsam sinks, then expressed.—**D.** A liquid having the appearance of sugar-house molasses, brownish-black, in thin layers reddish or

orange-brown and transparent; smoky balsamic odor and bitterish acrid taste.—**C.** About 60 per cent of cinnamein or benzylid cinnamate which is an oily aromatic liquid, about 30 per cent resin, about 6 per cent cinnamic acid, benzoic acid, etc. With age it resinifies, so that the proportion of resin increases, and it darkens in color. Soluble in alcohol and chloroform; partly soluble and miscible with fixed oils and fats.—**U.** Sometimes used internally as a stimulant blennorrhetic in doses of 0.5 to 2 grams. But mainly used as an ingredient of ointments for chillblains, sore nipples, ulcers and itch.

Styrax

N. Storax.—**O.** A balsam obtained by boiling and pressure from the wood and inner bark of *Liquidambar orientalis; Hamamelidaceæ.*—**H.** Asia Minor.—**D.** Semi-liquid, gray, opaque, viscid substance, from which a heavier dark brown, transparent stratum separates on standing; odor balsamic, taste balsamic acrid.—**C.** Styrol, cinnamic acid, styracin and other cinnamic esters, resin, etc.—**U.** Stimulant expectorant, blennorrhetic. Dose: About 1 gram several times a day. Mainly, however, externally, as an ingredient of liniments and ointments.

Liquidambar is a similar substance, obtained from *Liquidambar styraciflua; Hamamelidaceæ.* This tree is found in the United States, Mexico, and Central America. Liquidambar, or Sweet Gum, varies from a clear, thick, brownish-yellow fluid to a transparent yellowish-brown resin, which breaks with a resinous fracture when cold; plastic by the warmth of the hand; odor balsamic, resembling storax, and taste balsamic acrid.—**C.** About 5½ per cent cinnamic acid, resin, aromatic oily substance, etc.—**U.** Like those of Storax.

GROUP LXXXIII.

Volatile Oils.

The nature of volatile oils has been described in the introductory remarks to Group LXXX. It is a question whether these substances should be considered as drugs and I am inclined to hold, that, with perhaps a very few exceptions, they should rather be held to be preparations.

It is certain that they cannot be recognized by the ordinary physical characteristics, which enable us to recognize other drugs; nor can the quality be judged by their appearance, as we can do more or less satisfactorily in the case of other drugs.

The identity (not the quality or purity) of volatile oils can be recognized from an organoleptic property, the odor, but this cannot be described nor can an idea of it be conveyed by words. To say that oil of coriander has the odor of coriander conveys no idea to one who has not smelled coriander. The tests for purity are partly optical, by observing their behavior on polarized light, some of them rotating the plane of polarization to the right when they are called dextro-gyrate (dextrogyre), while some others rotate the plane of polarization to the left when they are called levo-gyrate (levogyre), while yet others are optically inactive; other tests are physical, as for instance, their specific gravity; the color is an organoleptic test, and moreover, is very variable, since nearly all volatile oils are nearly colorless when fresh, while many become yellowish, reddish, dark red to dark brown and even dark blue when older. Volatile oils frequently resinify and become thicker as they become older. They should therefore be kept in well-closed containers. The main tests for purity, however, are chemical, and volatile oils are therefore treated of at length in works on pharmaceutical chemistry or on pharmacy, and in colleges of pharmacy they are considered by the professor of pharmacy and not by the professor of materia medica and pharmacognosy.

For these reasons volatile oils will not be considered at length in this book, but the source and uses only will be mentioned in the briefest possible manner. For physical and chemical characteristics the student is referred to Remington's, Coblentz's or Caspari's Pharmacy, or one of the Dispensatories.

In all cases where no medicinal uses are stated the oils are mainly employed as perfumes in the manufacture of perfumery, soaps and cosmetic articles generally, but the same use is also made of many of those which are mentioned as medicinal agents.

Probably the only volatile oil that need be mentioned as a drug, is oil of turpentine.

A clear, limpid liquid with terebinthinate odor.....**Oleum Terebinthinæ.**

Oleum Terebinthinæ.

N. Oil of Turpentine, Spirits of Turpentine, generally spoken of as "turpentine."—**O.** Obtained by distillation from the oleoresin of *Pinus palustris* and other varieties of *Pinus; Coniferæ.*—**H.** The Southeastern States of the United States furnish the oil of turpentine used in this country.—**D.** A clear, limpid, neutral liquid, with a terebinthinate odor and bitterish terebinthinate taste.—**C.** It is the type of the *terpenes,* or hydrocarbons: $C_{10}H_{16}$; bromine and powdered iodine act violently on it; it ignites on being added to a mixture of sulphuric and nitric acids.—**U.** As a stimulant blennorrhetic; it has a peculiar and almost specific action in typhoid fever, in which it is very highly esteemed. Dose: 0.3 to 2 c.c. in emulsion. Also used as a vehicle or solvent in paints, varnishes, etc., and as an ingredient of liniments.

Oil of Allspice, *Oleum Pimentæ;* obtained by distillation from the fruit of *Pimenta officinalis (Eugenia Pimenta); Myrtaceæ.* Stimulant, stomachic and carminative. Dose: 0.2 to 0.3 c.c. (3 to 5 drops).

Oil of Amber, *Oleum Succini;* obtained by the destructive distillation of amber, afterwards rectified. Stimulant and antispasmodic. Dose: 0.3 to 0.5 c.c. (5 to 10 drops).

Oil of Anise, *Oleum Anisi;* obtained by distillation from the fruits of *Pimpinella Anisum; Umbelliferæ.* Stimulant, carminative. Dose: 0.3 to 0.5 c.c. (5 to 10 drops).

Oil of Bay, Oil of Bayberry, Oil of Myrcia, *Oleum Myrciæ;* a volatile oil distilled from the leaves of *Myrcia acris; Myrtaceæ.* Used in making bay rum.

Oil of Bergamot, *Oleum Bergamottæ;* obtained by expression from the rind of the fresh fruit of *Citrus Bergamia; Rutaceæ (Aurantiaceæ).* Used as a perfume.

Oil of Bitter Almond, *Oleum Amygdalæ Amaræ;* produced by distillation from bitter almonds macerated with water, the oil being formed by the reaction of water on amygdalin by the intervention of emulsin; amygdalin and emulsin are constituents of the seeds of *Prunus Amygdalus-amara; Rosaceæ.* Acts as a powerful depressant, like hydrocyanic acid. Dose: ¼ of a drop, cautiously increased until an effect is noticed. Also used as a flavor in weak dilutions. See, also, oil of mirbane.

Oil of Cajuput, Oil of Cajeput, *Oleum Cajuputi;* distilled from the leaves of *Melaleuca Leucadendron; Myrtaceæ.* Stimulant, carminative; in colic; externally in rheumatism, etc. Dose: 0.3 to 1 c.c. (5 to 20 drops).

Oil of Caraway, *Oleum Cari;* distilled from the fruits of *Carum Carui; Umbelliferæ.* As a flavor, and as a stimulant carminative; prevents griping. Dose: 0.05 to 0.5 (1 to 8 drops).

Oil of Cardamom, *Oleum Cardamomi;* distilled from the seeds of *Elettaria Cardamomum; Zingiberaceæ.* Used as a flavor.

Oil of Cassia, *Oleum Cinnamomi;* a volatile oil distilled from the bark of *Cinnamomum Cassia,* derived from undetermined species of *Cinnamomum; Lauraceæ.* Carminative; in colic, etc. Dose: 0.05 to 0.3 c.c. (1 to 5 drops).

Oil of Ceylon Cinnamon is similar, but not often used.

Oil of Cedarwood, *Oleum Juniperi Ligni;* distilled from the wood of Red Cedar, *Juniperus communis; Coniferæ.* For use in microscopical work and with homogeneous immersion lenses.

Oil of Citronella, *Oleum Andropogonis Nardi;* obtained by distillation from *Andropogon Nardus; Graminaceæ.* Used as a perfume.

Oil of Cloves, *Oleum Caryophylli;* obtained by distillation from the unopened flowers of *Eugenia aromatica; Myrtaceæ.* Stimulant, aromatic and carminative; also local narcotic in toothache from carious teeth. Dose: 0.05 to 0.3 c.c. (1 to 5 drops).

Oil of Copaiba, *Oleum Copaibae;* obtained by distillation from *Copaiba.* Stimulant and alterative, blennorrhetic and anti-gonorrhœic. Dose: 0.05 to 0.75 c.c. (1 to 12 drops).

Oil of Coriander, *Oleum Coriandri;* obtained by distillation from the fruit of *Coriandrum sativum; Umbelliferæ.* Carminative, but used mainly as a delicate and agreeable flavoring agent in elixirs, etc.

Oil of Cubeb, *Oleum Cubebæ;* distilled from the unripe fruit of *Piper Cubeba; Piperaceæ.* Stimulant, blennorrhetic and anti-gonorrhœic. Dose: 0.5 c.c. (about 8 drops), gradually increased as necessary.

Oil of Dill, *Oleum Anethi;* distilled from the fruit of *Anethum graveolens; Umbelliferæ.* Carminative. Dose: 0.05 to 0.25 c.c. (1 to 4 drops).

Oil of Erigeron, see Oil of Fleabane.

Oil of Eucalyptus, *Oleum Eucalypti;* obtained by distillation from the leaves of *Eucalyptus globulus; Myrtaceæ.* Antispasmodic and antineuralgic. Dose: 0.3 to 0.5 c.c. (5 to 10 drops), in capsules.

Oil of Fennel, *Oleum Fœniculi;* distilled from the fruit of *Fœniculum vulgare; Umbelliferæ.* Carminative, antispasmodic. Dose: 0.3 to 1 c.c. (5 to 15 drops).

Oil of Fleabane, Oil of Canada Fleabane, Oil of Erigeron, *Oleum Erigerontis;* obtained by distillation from the fresh-flowering herb of *Erigeron Canadense; Compositæ.* Acts like oil of turpentine in diarrhœas, dysentery and hemorrhages. Dose: 0.5 to 1 c.c. (10 to 15 drops) in capsules.

Oil of Ihlang-Ihlang, see Ylang-Ylang.

Oil of Juniper, *Oleum Juniperi;* a volatile oil distilled from the fruit of *Juniperus communis; Coniferæ.* Stimulant, carminative and diuretic. Dose: 0.3 to 0.5 c.c. (5 to 10 drops).

Oil of Lavender Flowers, *Oleum Lavandulæ;* distilled from the flowers or flowering tops of *Lavandula vera; Labiatæ.* The best oil is made from the flowers alone. Mainly as flavor or perfume.

Oil of Lemon, *Oleum Limonis, Oleum Citri;* obtained by mechanical means from the rind of the fruit of *Citrus medica Limonum; Rutaceæ (Aurantiaceæ).* Used as a flavor.

Oil of Lemon Grass, *Oleum Andropogonis;* distilled from *Andropogon citratus* and other grasses of the genus *Andropogon; Graminaceæ.* As a perfume.

Oil of Mace, *Oleum Macidis;* distilled from the arillus of *Myristica fragrans; Myristicaceæ.* For flavoring.

Oil of Mirbane, Nitrobenzol, Artificial Oil of Bitter Almonds; a synthetic product. As a perfume and flavor.

Oil of Mustard, *Oleum Sinapis volatile;* a volatile oil obtained from the seeds of *Brassica nigra; (Cruciferæ)* by maceration with water and subsequent distillation. The oil does not exist in the seed, but is produced by the decomposition of sinigrin (potassium myronate) under the influence of myrosin, an albuminous ferment, in presence of water. Used as an external stimulant and counter-irritant.

Oil of Neroli, is the best grade of Oil of Orange Flowers, which see. The word *neroli* is indeclinable and neuter.

Oil of Nutmeg, *Oleum Myristicæ, Oleum Nucistae aethereum;* a

volatile oil distilled from the seeds of *Myristica fragrans; Myristicaceæ*. Carminative in doses of about 0.1 to 0.2 c.c. (2 to 3 drops), but mainly employed as a flavor.

Oil of Orange Flowers, *Oleum Aurantii Florum,* Oil of Neroli; distilled from the fresh flowers of the bitter orange, *Citrus vulgaris; Rutaceæ (Aurantiaceæ).* Used for flavoring and perfume.

Oil of Orange Peel, *Oleum Aurantii Corticis;* a volatile oil obtained by expression from the rind of the bitter orange, *Citrus vulgaris,* or the sweet orange, *Citrus Aurantium Sinensis; Rutaceæ (Aurantiaceæ).* Used for flavoring and perfume.

Oil of Origanum; commercial oil of origanum is oil of thyme, which see.

Oil of Patchouli, *Oleum Pogostemonis,* distilled from the leaves of *Pogostemon Patchouli; Labiatæ.* The word *patchouli* is indeclinable and neuter. Used in perfumery mainly on account of its conferring lasting properties on other more delicate and evanescent perfumes.

Oil of Pennyroyal, *Oleum Hedeomæ;* distilled from the leaves and flowering tops of *Hedeoma pulegioides; Labiatæ.* Carminative and emmenagogue. Dose: 0.1 to 0.5 c.c. (2 to 10 drops). Used also as a local application to keep away mosquitos.

Oil of Peppermint, *Oleum Menthae Piperitæ;* obtained by distillation from the whole plant *Mentha piperita; Labiatæ.* Stimulant carminative in flatulence, colic, etc. Dose: 0.1 to 0.3 c.c. (2 to 5 drops).

Oil of Rhodium (genuine) is said to be obtained from the root (wood?) of *Convolvulus scoparius* (?) or from *Genista Canariensis* (?), authors not agreeing on the subject. Commercial oil of rhodium is said to be a mixture of 1 part of oil of rose with 20 parts oil of copaiba; it is used as a lure or bait for rats and other animals, and is also said to be used by tamers and trainers of animals.

Oil of Rose, *Oleum Rosæ,* Otto of Roses, Attar of Roses; obtained by distillation from the fresh flowers of *Rosa Damascena; Rosaceæ.* Used for flavoring and perfumery.

Oil of Rosemary, *Oleum Rosmarini;* a volatile oil distilled from the leaves of *Rosmarinus officinalis; Labiatæ.* Stimulant carminative in doses of 0.1 to 0.3 c.c. (2 to 5 drops), but mainly used as an external stimulant in liniments.

Oil of Rue, *Oleum Rutæ;* distilled from the whole herb *Ruta graveolens; Rutaceæ.* Local irritant; in large doses causing intestinal inflammation and convulsions; used as an emmenagogue in doses of 0.1 to 0.3 c.c. (2 to 5 drops) every 2 or 3 hours.

Oil of Sandal Wood, *Oleum Santali,* Oil of Santal; obtained by distillation from the wood of *Santalum album; Santalaceæ.* Blennorrhetic, anti-gonorrhœic. Dose: About 1 c.c. in capsules.

Oil of Sassafras, *Oleum Sassafras;* obtained by distillation from the bark of *Sassafras variifolium; Lauraceæ.* Used for flavoring. The word *sassafras* is indeclinable and neuter.

Oil of Savin, *Oleum Sabinæ;* distilled from the tops of *Juniperus Sabina; Coniferæ.* Powerful emmenagogue, in large doses abortifacient, and gastrointestinal irritant and poison. Dose: 0.1 to 0.3 c.c. (2 to 5 drops); a quantity sufficiently large to produce abortion is very apt also to kill the woman.

Oil of Spearmint, *Oleum Menthæ Viridis;* obtained by distillation from the fresh-flowering herb *Mentha viridis; Labiatæ.* Stimulant carminative in flatulence, colic, etc. Dose: 0.1 to 0.3 c.c. (2 to 5 drops).

Oil of Star Anise, *Oleum Illicii;* most of the commercial oil of anise is really oil of star anise. See Oil of Anise.

Oil of Sweet Birch, *Oleum Betulæ Volatile;* a volatile oil from the bark of *Betula lenta; Betulaceæ.* Nearly identical with oil of wintergreen, and used in the same manner. See Oil of Wintergreen.

Oil of Tansy, *Oleum Tanaceti;* distilled from the leaves of *Tanacetum vulgare; Compositæ.* Sometimes used for criminal purposes, to produce abortion; very uncertain and *very dangerous* in its action.

Oil of Tar, *Oleum Picis Liquidæ;* a volatile oil distilled from pine tar. Blennorrhetic, expectorant. Dose: 0.05 to 0.3 c.c. (1 to 5 drops).

Oil of Thyme, *Oleum Thymi;* this oil is also usually sold as "oil of origanum;" obtained by distillation from the leaves and flowering tops of *Thymus vulgaris; Labiatæ.* Diffusible stimulant and antiseptic. Dose: 0.1 to 0.5 or 1 c.c. (2 to 8 or 15 drops).

Oil of Wintergreen, *Oleum Gaultheriæ;* a volatile oil distilled from the fresh leaves of *Gaultheria procumbens; Ericaceæ.* Mainly

used for flavoring, but is occasionally used as an anti-rheumatic, like salicylic acid.

Oil of Worm-seed, *Oleum Chenopodii,* Oil of American Worm-seed; obtained by distillation from the fruit of *Chenopodium ambrosioides,* var. *anthelminticum; Chenopodiaceæ.* Anthelmintic. Dose: 0.25 to 0.5 c.c. (4 to 8 drops) for a child, morning and evening, followed by a brisk cathartic.

Oil of Ylang-Ylang, distilled from the flowers of *Cananga odorata; Anonaceæ.* Used only in the manufacture of perfumery.

GROUP LXXXIV.

Fixed Vegetable Oils and Fats.

Fixed oils and fats are contained in the cells of many plants, especially in the seeds of many plants. From these sources they may be obtained by expression between warmed steel cylinders, more rarely by boiling in water and skimming, or by the aid of solvents, such as benzin, benzole, ether, bisulphide of carbon, etc.

Fatty oils are neutral, lighter than water and insoluble in it, only slightly soluble in alcohol, except castor oil, which is freely soluble in it, usually colorless or pale yellowish, more or less bland and insipid, not volatilizable, burn with a clear flame by aid of a wick, make permanent fatty stains in bibulous paper, rendering the paper translucent. Exposed to the air, they gradually absorb oxygen and become rancid (non-drying oils) or dry to a transparent hard substance (drying oils).

In composition they vary somewhat, but consist mainly of a mixture of fatty bodies termed glycerides, of which stearin, palmitin and olein are the more important ones; stearin and palmitin preponderate in the solid fats, olein in the fluid fats or oils. By the action of strong bases these glycerides are decomposed, the base uniting with the stearic, palmitic and oleic acids of the glyceride and glycerin being liberated or produced. If the base used for this purpose is an alkali, as when potash or soda lye is used, the salts of the fatty acids are called *soaps;* if the base is litharge (an oxide of lead), the resulting salts of the fatty acids are called *plasters.*

We will divide the vegetable oils into three subdivisions to facilitate recognition: Solid Fats, Soft-Solid or Semi-Liquid

Fats, and Liquid Fats or Oils. It is customary to call all of them "oils," regardless of their consistence.

A division into "Drying Oils" and "Non-drying Oils" is, of course, of no value in a system of pharmacognosy intended for the use of the retail pharmacist, even though by the addition of nitrous acid, which causes non-drying oils to solidify within a few days, the distinction can be made.

But it is of value to know that drying oils are of use in paints and varnishes, and in making the "body" of tube oil colors, etc. The most important drying oil is linseed oil; poppy oil, walnut seed oil and hempseed oil are also drying oils, used in the preparation of artists' materials, but of no importance to pharmacists.

Unfortunately, in this group, as in the previous one, the organoleptic properties of odor and taste, which cannot be described, are the most reliable characteristics for identification and the student is advised to familiarize himself with them.

The animal oils and fats have been considered in their proper places, Groups, VI, VII, and VIII.

Solid Vegetable Fats

Consistence of tallow, yellowish-white, odor of chocolate .... **Butyrum Cacao.**

Consistence of tallow, orange-colored or mottled white and brownish, odor of nutmeg.......... **Butyrum Nucistæ.**

Solid diaphanous substance resembling white wax. **Paraffinum.**

Bear in mind also the animal fats

Hard, white, somewhat glossy masses. (See Group VI) .... **Acidum Stearicum.**

White, solid fatty masses. (See Group VI)...... **Sevum.**

Semi-solid fats

Of the consistence of butter or lard, granular, green .... **Oleum Lauri.**

Of the consistence of butter, white; disagreeable odor .... **Oleum Cocois.**

Of the consistence of butter, orange-colored; violet-like odor .... **Oleum Palmæ.**

Of the consistence of a cerate or ointment, yellowish, slightly fluorescent..................... **Petrolatum.**

Bear in mind also the animal fats

Soft, white, unctuous fatty substance. (See Group VII) .... **Adeps.**

Soft, yellowish-white fatty substance. (See Group VII) .... **Adeps Lanæ.**

Liquid Oils

Thin, clear, pale yellow oil, with nutty odor and bland taste .... **Ol. Amygdalæ Expressum.**

Pale yellow oil, without odor and with a bland nutty taste .... **Ol. Gossypii Seminis.**

Yellowish to yellowish-brown oil, with peculiar odor and bland taste.......................... **Ol. Lini.**

Pale yellow, or light greenish-yellow oil, peculiar odor and nutty taste.......................... **Ol. Olivæ.**

Viscid, nearly colorless oil, odor mildly nauseous; taste bland, but afterwards acrid............ **Ol. Ricini.**

Yellowish oil, odorless, and with a bland, nut-like taste .... **Ol. Sesami.**

Yellowish-brown, somewhat viscid; odor unpleasant and taste acrid.......................... **Ol. Tiglii.**

Bear in mind also the animal oils

Yellowish to brownish oil with fishy odor. (See Group VIII) .... **Ol. Morrhuæ.**

Pale yellowish or colorless fixed oil. (See Group VIII) .... **Ol. Adipis.**

Pale yellow to yellowish-brown oil. (See Group VIII) .... **Ol. Bubulum.**

Oleum Theobromatis Expressum

N. *Butyrum Cacao*, Oil of Theobroma, Butter of Cacao.—**O.** Obtained by expression between heated plates from the seeds of *Theobroma Cacao; Sterculiaceæ.*—**H.** South America.—**D.** Yellowish-white, becoming white by age, solid, harder than tallow; odor aromatic, taste bland and chocolate-like.—**C.** Stearin, olein, etc.; sp. gr. about 0.96 to 0.97 at 25° C.—**U.** For making suppositories.

Oleum Myristicæ Expressum

N. *Oleum Nucistæ, Butyrum Nucistæ*, Butter of Nutmeg.—**O.** Obtained by expression between heated plates from the ground seeds of *Myristica fragrans; Myristicaceæ.*—**H.** Cultivated in the

Molucca Islands.—**D.** Brick-shaped blocks, of the consistence of tallow, granular, orange-colored or mottled white and brownish; odor and taste aromatic, nutmeg-like.—**C.** About 25 to 30 per cent myristin, olein, palmitin, some volatile oil; sp. gr. about 0.995.—**U.** Mainly employed externally in ointments; of no particular medicinal value.

Paraffinum

N. Paraffine.—**O.** Obtained from the solid residues when coal-oil, etc., are distilled from crude rock-oil or petroleum; also from minerals saturated with hydrocarbons, especially shale. We have neither time nor space to discuss here whether these substances are altogether, or even mainly, fossil oils of vegetable origin *as is generally held,* or whether they are also in part, or mainly, or altogether, the product of animals of previous geologic ages, as is contended by others, or mixtures of the two. We simply accept the generally received theory and ascribe them to vegetable origin without wishing to have this construed into an expression of opinion on a mooted question in a department of science on which the writer possesses insufficient knowledge to entitle him to express an opinion. Fossil or rock oils bear the same relation to recent vegetable (or animal?) oils as does amber to recent oleo-resins and resins, or does asphaltum to recent pitch.—**D.** A white, waxy substance, harder than tallow, softer than wax; odorless and tasteless.—**C.** Made up of hydrocarbons between $C_{24}H_{50}$ and $C_{27}H_{56}$; sp. gr. about 0.877; it is not affected by strong mineral acids and is therefore used to seal stoppers in bottles and carboys containing the latter.—**U.** Medicinally, none; in the arts it is used in many ways, as in paraffined paper, making candles, etc.

Oleum Lauri

N. Laurel Oil.—**O.** A fixed oil obtained by macerating the mashed fruit of *Laurus nobilis (Lauraceæ)* in hot water for several hours and then expressing.—**H.** Levant and Southern Europe.—**D.** Of the consistence of butter or ointment, granular, green color; with a strong odor of the fruit; taste aromatic, spicy, bitter.—**C.** Sp. gr. about 0.85 to 0.90; laurin, olein, volatile oil, etc.—**U.** Used in liniments and ointments. A use not gen-

erally mentioned is, that it is obnoxious to mosquitoes; moreover when mixed with pennyroyal oil the latter is not as readily dissipated as when it is applied in the form of an alcoholic spirit or solution. Pennyroyal oil mixed with laurel oil has been found an excellent protector against mosquitoes by the author on his fishing trips.

Oleum Cocois

Cocoa Nut Oil is obtained in tropical countries from the seeds of *Cocos nucifera (Palmaceæ)* by boiling in water and expressing. It is white, of the consistence of butter, and has a disagreeable odor because it becomes rancid so rapidly that it is rare to meet with a sample of fresh oil. The pulp of the cocoanut, dried in the sun, is called *copra;* this is imported and the oil is obtained from this by expression or decoction. Used in the making of soaps and hair oils, and to some extent in cosmetic preparations.

Oleum Palmæ

Palm Oil is obtained in tropical countries from the fruits of *Elæis Guincensis (Palmaceæ)* by boiling the fruits in water and expressing. It is harder than butter, and orange-colored; odor violet-like, agreeable; easily becomes rancid and offensive. Used for making candles, soaps, etc.; not an article in the retail drug trade, but much used by printers.

Petrolatum

N. Petrolatum, Vaseline, Cosmoline, etc.—**O.** Similar to that of paraffine, which see. "A mixture of hydrocarbons, chiefly of the marsh-gas series, obtained by distilling off the lighter and more volatile portions from petroleum and purifying the residue when it has the desired melting point" (U. S. P.).—**D.** Of the consistence of a cerate or ointment; yellowish, with a slight greenish fluorescence. The substance may be prepared, however, of any consistence, from a liquid condition to that of a stiff cerate. In pharmacy it is mainly employed as a base or vehicle for ointments and therefore petrolatum of the consistence of an ointment (*petrolatum molle*, melting point about 40° to 45° C., sp. gr. at 60° C. 0.820 to 0.840) or of a cerate (*petrolatum spissum*,

melting point about 45° to 51° C., sp. gr. at 60° C. 0.820 to 0.850) is most frequently used.

Oleum Amygdalæ Expressum

N. Almond Oil, Sweet Oil of Almonds.—**O.** Fixed oil expressed from the seeds of *Prunus Amygdalus (Amygdalus communis); Rosaceæ.* Made from both sweet and bitter almonds, but mainly from the bitter variety; the press-cake of bitter almonds is then macerated with water and oil of bitter almonds distilled from it; the press-cake of sweet almonds is ground and sold as "almond meal" as a cosmetic.—**H.** Cultivated in the Orient, Mediterranean countries and California.—**D.** Thin, clear, pale-yellow oil with nutty odor and bland taste.— **C.** Mainly olein, a little palmitin; sp. gr. about 0.918.—**U.** Demulcent, slightly laxative. Dose: 5 to 15 c.c., best in emulsion.

Sometimes adulterated with the expressed oil of peach kernels; see tests in the pharmacopœia.

Oleum Gossypii Seminis

N. Cotton Seed Oil.—**O.** The fixed oil expressed from the seeds of *Gossypium herbaceum (Malvaceæ)* is purified and bleached.—**H.** Subtropical countries; mainly Southern part of United States.—**D.** Pale yellow oil, without odor and with a bland nutty taste.—**C.** Olein, palmitin, and yellow coloring principle; sp. gr. about 0.922 to 0.925.—**U.** Demulcent. Mainly used for culinary purposes, for making substitutes for lard or butter, etc.

Oleum Lini

N. Linseed Oil.—**O.** A fixed oil expressed from the seeds of *Linum usitatissimum; Linaceæ.*—**H.** Cultivated in the Levant, Europe and United States.—**D.** A yellowish to yellowish-brown limpid oil with peculiar odor and bland taste.—**C.** Mainly linolein, which makes it a "drying oil," some palmitin, myristin, etc.; sp. gr. about 0.935.—**U.** Seldom used internally, but occasionally used externally as an ingredient of Carron Oil, or lime liniment, used as an application in burns, as a protective. Mainly used in paints, varnishes, etc.

Boiled Linseed Oil is prepared by boiling linseed oil with so-called "dryers," such as litharge, red lead, sugar of lead, manganese dioxide, etc.; this renders it a better drying oil, but care must be taken that boiled linseed oil is not used internally instead of pure linseed oil, as the boiled oil is poisonous. Linseed oil is often used as a laxative in cases of colic in horses, cows, etc., and cases are on record where the administration of boiled linseed oil has proved fatal to such animals.

Oleum Olivæ

N. Olive Oil, Sweet Oil.—**O**. A fixed oil obtained from the fruits of *Olea Europæa; Oleaceæ*. There are several grades of this oil: *Virgin Oil,* obtained by cold pressure; a second grade oil, obtained by mixing the press-cake with hot water and again expressing; and an inferior oil obtained from the residue of this second pressing after it has undergone fermentation. This last grade of oil is mainly used in the manufacture of Castile soap.—**H**. Asia and Southern Europe.—**D**. Pale yellow or light-greenish-yellow oil; peculiar odor and sweet, nutty taste.—**C**. Mainly olein, some palmatin, etc.; sp. gr. about 0.915.—**U**. As a table or salad oil; as a demulcent; externally in emollient and cosmetic preparations.

Bland fixed oils resembling olive oil in appearance and sometimes used for adulterating olive oil, sometimes used as substitutes, but comparatively seldom employed under their own proper names, are made from mustard seeds, walnuts, pecans, etc. The latter especially is a fine salad oil, and when it can be obtained is esteemed more highly than the best olive oil.

Oleum Ricini

N. Castor Oil.—**O**. A fixed oil expressed from the seeds of *Ricinus communis; Euphorbiaceæ*.—**H**. Cultivated.—**D**. A viscid, nearly colorless oil; odor mildly nauseous, taste bland, but afterwards acrid and nauseous.—**C**. A peculiar modification of olein called ricinolein, palmitin, an acrid principle, etc.; sp. gr. about 0.965.—**U**. Laxative, in large doses purgative. Dose: 5 to 25 c.c.

Oleum Sesami

N. Benne-Seed Oil.—**O.** A fixed oil obtained by expression from the seeds of *Sesamum Indicum (S. orientale); Pedaliaceæ.*—**H.** India; cultivated.—**D.** A yellowish fixed oil, limpid, transparent, odorless, with a bland nut-like flavor.—**C.** Olein, palmitin, stearin, etc.; sp. gr. about 0.922.—**U.** Like those of olive oil.

Oleum Tiglii

N. Croton Oil.—**O.** A fixed oil expressed from the seeds of *Croton Tiglium; Euphorbiaceæ.*—**H.** India and Philippine Islands.—**D.** A more or less viscid fixed oil, the viscidity increasing with age, varying in color from yellow to dark reddish-brown, the color deepening with age; odor peculiar, taste disagreeable, acrid and irritating.—**C.** Glycerides of various fatty acids, such as tiglinic, palmitic, stearic, lauric; the purgative, vesicating and suppurant properties depend upon a substance containing a fatty acid resembling ricinoleic acid; sp. gr. about 0.95.—**U.** Drastic cathartic. Dose: 0.05 to 0.1 gram, best given in an emulsion with some mild demulcent oil. Externally croton oil is counterirritant, vesicant and suppurative.

GROUP LXXXV

Peculiar Concrete Substances

A number of substances that do not conform to the characteristics described under the previous groups of non-cellular vegetable substances are placed in this group, although they do not resemble each other markedly and, in fact, have no general characteristics in common. The group is therefore based on considerations of convenience mainly.

White, translucent, crystalline masses; peculiar penetrating odor and bitterish pungent taste........................**Camphora.**

In cakes, balls, hollow bottle-shaped or irregular pieces, blackish-brown, very elastic..................................**Elastica.**

Grayish or yellowish-gray masses, streaked interiorly; not markedly elastic ....**Gutta Percha.**

Light, friable, grayish-green flattish fragments; acrid, bitter..**Elaterium.**

Camphora

N. Camphor.—**O.** Crude camphor is obtained by distillation from the chipped wood and branches of *Cinnamomum (Laurus) Camphora; Lauraceæ.* The crude camphor is purified by sublimation.—**H.** China, Japan and India.—**D.** White, translucent masses having a crystalline structure, tough and not readily pulverizable unless a little alcohol, ether or chloroform is added; odor peculiar, strong, penetrating and persistent, taste bitterish pungent.—**C.** Camphoric and camphoronic acids; composition of camphor is $C_{10}H_{16}O$; it sublimes at ordinary temperatures and volatilizes completely when exposed to the air; it burns with a brilliant, though smoky flame and leaves no ash; dissolves completely in acohol, ether, volatile and fixed oils, etc.; sp. gr. about 0.99.—**U.** Stimulant of the brain and circulation; useful in low fevers and typhoid conditions; also useful in cholera, etc., alone or in combination with opium. Anaphrodisiac and sedative in priapism, chordee, etc. Used externally in bruises, rheumatism, etc. Dose: 0.05 to 0.3 grams; as an anaphrodisiac or as a sedative in mania, up to 1 gram.

Elastica

N. *Caoutchouc,* India-Rubber; the word *caoutchouc* is indeclinable and neuter.—**O.** and **H.** Obtained by exudation from incisions in the stems of various trees, but especially "from the natural orders *Euphorbiaceæ (Siphonia, Hevea, Jatropha), Apocynaceæ (Urceola, Vahea, Landolphia),* and *Artocarpaceæ (Ficus, Urostigma, Castilloa,* etc.)." In India *Ficus elastica* is the main source of this substance; in Africa, *Landolphia florida* and other varieties of *Landolphia;* in South America, *Hevea Guianensis* and other varieties of *Hevea.*—**D.** India rubber occurs in flat cakes, in balls or moulded into various hollow bottle-shaped masses; the latter are made by dipping moulds of clay into the india-rubber while still fluid and continuing this until the layer is sufficiently thick, then breaking the clay mould and pouring out the fragments of clay. Externally caoutchouc is blackish-brown, but internally on a cut surface, it is lighter colored and sometimes grayish or whitish striated. It is very elastic, odorless and without taste.—**C.** Consists of a mixture of polyterpenes; but the

principal constituent is a solid hydrocarbon, gutta, $C_{20}H_{32}$. Soluble in chloroform, etc. The best method of dissolving is said to be to change it to a jelly-like substance in carbon disulphide and then dissolve this jelly in benzin. With 10 per cent of sulphur caoutchouc vulcanizes and forms *hard rubber.*—**U.** Externally for dressings and plasters. In the arts for making soft and hard rubber goods.

Gutta Percha

N. Gutta Percha, Guetah, or Guetta-pertcha, a Malay name, indeclinable and neuter.—**O.** Obtained from incisions in *Palaquium oblongifolium* and allied trees; *Sapotaceæ.*—**H.** Malayan peninsula and islands.—**D.** In masses of a grayish or grayish-white color, often with brownish streaks, hard, heavier than water, not very elastic, but flexible; impurities can be removed from it by kneading in hot water. Nearly odorless and tasteless.—**C.** About 80 per cent gutta ($C_{20}H_{32}$), resins, etc.; soluble in ether, benzol, chloroform, carbon disulphide and oil of turpentine; sp. gr. about 0.98; it may be vulcanized like caoutchouc.—**U.** Like those of caoutchouc.

A peculiar substance resembling gutta percha and called "chicle gum" is obtained from a Mexican tree, *Mimusops Balata; Sapotaceæ;* it is used in the manufacture of chewing gum.

Elaterium

N. Elaterium.—**O.** A peculiar substance deposited from the juice of the squirting cucumber, *Ecballium Elaterium; Cucurbitaceæ.* The juice is clear when it first comes from the fruit, but soon becomes turbid from the elaterium which separates from it and is deposited. The deposit is spread in thin layers on muslin and then rapidly dried between sheets of bibulous paper.—**D.** In flat fragments of variable thickness, a few mm. thick, irregular size, easily broken, with a granular fracture, grayish or grayish-green, showing the impression of the muslin on one side; a slight odor suggesting tea, and an acrid and very bitter taste.—**C.** About 25 to 35 per cent of elaterin; this is the only valuable constituent. Elaterin is a resinoid substance, but, constituting only about ⅓ of the drug, the latter cannot fairly be classed with

the resins, as is done by some authors.—**U.** A powerful hydragogue cathartic. Dose: 0.008 to 0.015 gram.

Great care should be exercised in writing, reading and dispensing **elaterium** *and* **elaterinum** *in order that the two may not be confounded* on account of the similarity *of their names.* Elaterin consists of small, shining crystals, odorless, intensely bitter and acrid and from 3 to 4 times as active as elaterium.

GROUP LXXXVI

Coloring Matters

Substances prepared by oxidation or fermentation from various plants; or by the deposition of sediments from their juices extracted by water.

More or less firm, brittle masses; blue to purplish................**Indigo.**
Small, rectangular, blue or bluish cakes; colors water blue........**Litmus.**
A purplish-red powder, imparting a beautiful color to diluted alcohol ....**Persio.**
Thick, deep reddish-purple liquid with ammoniacal odor............**Orchil.**
Usually an orange-red paste; sometimes dry and friable cakes.....**Annatto.**

Indigo

N. *Indicum,* Indigo; the word *indigo* is indeclinable and neuter.—**O.** The whole plants of several varieties of *Indigofera (Leguminosæ)* and allied plants are packed in cemented reservoirs a few feet deep, and then covered with water. After fermenting for a few days the workmen express the juice from the plants by jumping in the reservoir and treading the mass, at the same time agitating the water to facilitate oxidation. The liquid becomes deep blue and at the proper time is drawn off and allowed to deposit the coloring matter.—**H.** India.—**D.** More or less firm, brittle masses, of a blue to purplish-blue color, showing a bronze or coppery metallic appearance when pressed by a smooth hard body, as by the nail of the finger; odorless and tasteless.—**C.** Should contain from 70 to 80 per cent of indigo-blue or indigotin.—**U.** Used only as a coloring agent or dye, and in solution as a test solution.

Litmus

N. Litmus, Lacmus.—**O.** Made by a process of fermentation from lichens, including *Roccella tincturia* and other varieties of

Roccella, several *species of Lecanora, Variolaria,* etc; *Lichenaceæ.* The juices of the plants themselves are colorless, but become colored during the processes employed, which are under control so that several different and distinct coloring matters can be produced.—**H.** Mainly made in Holland. The coarsely powdered lichens are macerated in a mixture of urine of cattle and horses, lime and potash or soda; the liquid becomes first red, finally blue; the liquid is then separated, mixed with calcareous or silicious matter and some indigo, moulded into small cakes and dried.—**D.** It occurs in rectangular, blue or bluish cakes, 2.5 cm. or less in size, light, friable, granular, and dotted with white saline dots; odor violet-like, taste somewhat saline and pungent.—**C.** A coloring matter, orcein, which is soluble in water and still more readily in alcohol; as it always contains chalk it effervesces with acids.—**U.** Test for acids and alkalies. In the arts as a dye.

Persio, Cudbear, is made in a similar manner, from the same lichens, by macerating in an ammoniacal liquid (urine and lime), but probably more potash or soda is added than when making litmus or orchil. Cudbear is in the form of a purplish-red powder. Used to color elixirs, etc., and in the arts as a dye.

Orchil or Archil is made in a similar manner, from the same lichens, but probably by adding but little potash or soda to the urine and lime. It is a thick, deep reddish-purple liquid, but varies in tint, some lots being more some less reddish. Used as a dye.

Annatto

N. Orleana, Annatta, Arnotta; the word *annatto* is indeclinable and neuter.—**O.** A reddish pulp surrounding the seeds of *Bixa Orellana; Bixaceæ.* The pulp is separated by bruising the fruit, mixing with water, straining, allowing the sediment to deposit and then forming into cakes, which are dried.—**H.** Guiana and other parts of South America.—**D.** Usually the cakes are quite soft, forming, in fact, a stiff, pasty mass; occasionally they are dry so that they may be broken, brownish-red, with a peculiar sweetish odor and a saline bitterish taste.—**C.** A peculiar coloring principle, bixin; another called orellin; etc.—**U.** As a dye and coloring agent. Often used as a color for butter.

SYNOPSIS OF THE GROUPS OF DRUGS

This synopsis is to be used in connection with the chart, "System of Pharmacognosy," for the determination of drugs in the ordinary business emergencies, when a specimen of drug of which the customer does not know the name may be brought in with a demand for a drug of the same kind. After a little practice, and especially after this book has been studied, this system will assist in determining the identity of such a drug. Our failure to recognize a drug is often not because we do not know the drug, but because we cannot recall its name, and, therefore, cannot go to the drawer or container in which it is kept, and in such a case this synopsis will be of immediate and prompt assistance.

Suppose a customer brings in a piece of pomegranate rind; we see at once that it is a vegetable substance, and this excludes all animal drugs, or the first eight groups of drugs. We see at a glance that it is not a whole plant (excludes the ninth group), that it is not a cryptogam (excludes Groups X to XV), nor any underground form of structure, such as root, rhizome, corm or bulb (excludes Groups XVI to XXXIII), nor is it any part of the stem, such as twigs, pith, wood or bark (excluding Groups XXXIV to XLV), nor is it a leaf-bud, leaf or flower (thus excluding Groups XLVI to LVII); we now have come to fruits, and the specimen is evidently not a whole fruit (excluding Groups LVIII to LXIV), but a part of fruit, and, therefore, belongs in Group LXV. Turning now to Group LXV in this *synopsis* we find an enumeration of the drugs which are parts of fruits, and merely reading the names will probably recall the correct name for the drug, but if not, the compendious descriptions will enable us to determine its name. We know it is not lemon or orange peel, and probably even the novice in the drug business knows that it is neither tamarinds nor white pepper, so that we need look up only bael fruit, mangosteen and pomegranate rind, and the description will tell us that it is the

latter; but, to make sure, we turn to the page indicated and read the description of the drug, and compare with the drawing, and thus establish the identity.

And so for any drug, *once we determine what it is;* that is, whether it is a whole animal or plant, or a part of an animal or plant, or non-cellular animal or plant substance, or a starch, etc.; and, while this *synopsis* and these *notes* do not contain all the drugs, it is believed that they contain practically all that are apt to be met with in actual business experience.

While this use of the author's *system of pharmacognosy* is best made in connection with the *chart,* which should hang in a place that is convenient for ready reference, yet pages 22 to 27 of this book will enable the druggist to get at the same results, but with a little more labor and time.

The numbers following the names constitute a page index.

Group I

Worms

A live aquatic worm .... **Hirudo,** 32.

Group II

Insects

Without wings; angular granules .... **Coccus,** 33.
With wings greenish or coppery metallic luster .... **Cantharis,** 33.
Wings black with transverse yellow bands .... **Mylabris,** 34
Wings black with longitudinal yellow bands .... **Canth. vittata,** 34.
Entire insect, brownish-black .... **Blatta,** 34.

Group III

Eggs

The egg of the chicken .... **Ovum,** 35.

Group IV

Parts of Animals Wholly or Partly Soluble in Alcohol or Water

Rolls or flat pieces of tough fibrous tissue............ **Ichthyocolla**, 35.
Long, thin, membranous ribbons...................... **American Isinglass**, 36.
Round sacs, hairy on one side, smooth on the other.... **Moschus**, 36.
Long grayish-brown sacs............................ **Castoreum**, 37.

Group V

Parts of Animals Not Soluble in Alcohol or Water

Anastomosing fibers .... **Spongia**, 39.
Flattish, oval, white "bones"....................... **Os Sepiæ**, 40.

Group VI

Solid Non-Cellular Animal Substances

Round, white, calcareous stones..................... **Lapilli Cancrorum**, 41.
Yellow, waxy cakes, or lumps....................... **Cera Flava**, 42.
Thin, round or square cakes, waxy, white............. **Cera Alba**, 43.
White, semi-transparent, unctuous masses of a crystalline, foliaceous texture.......................... **Cetaceum**, 43.
Hard, white, somewhat glossy masses................. **Acidum Stearicum**, 44.
White, solid, fatty masses.......................... **Sevum**, 44
Black, gritty powder.............................. **Carbo Animalis**, 44.
Brown, unctuous, very odorous powder................ **Moschus**, 45.
Cylindrical, hard, crystalline masses................. **Saccharum Lactis**, 45.
Flat, hard, brown, transparent or translucent pièces... **Colla**, 45.
Irregular, flat, semi-opaque, yellowish-white pieces.... **Colla Alba**, 46.
Colorless, transparent, rectangular, flexible sheets...... **Gelatina**, 46.
Opaque, rectangular sheets of frothy texture.......... **Gelatin**, 46.
Clear, colorless flexible shreds...................... **Shred Gelatin**, 46.
Grayish-brownish or blackish odorous masses.......... **Ambergris**, 46.
Small, hard, tenacious, odorous masses................ **Hyraceum**, 47.

Group VII

Semi-Solid Amorphous Animal Substances

Soft, white, unctuous fatty substance................ **Adeps**, 47.
Soft, yellowish-white fatty substance................. **Adeps Lanæ**, 47.
Semi-solid, unctuous, yellowish or brownish substance.. **Civet**, 48.

Group VIII

LIQUID AMORPHOUS ANIMAL SUBSTANCES

Syrupy, sweet, aromatic, sometimes granular liquid.... **Mel,** 48.
Viscid, greenish-brown bitter liquid.................. **Fel Bovis,** 49.
Yellowish to brownish fixed oil with fishy odor........ **Oleum Morrhuæ,** 49.
Pale yellowish or colorless fixed oil.................. **Oleum Adipis,** 50.
Pale yellow to yellowish-brown oil.................... **Oleum Bubulum,** 50.

Group IX

HERBS—WHOLE PLANTS BOTANICALLY RECOGNIZABLE

Compositæ:

Yellowish florets; leaves petiolate, pinnatifid.......... **Absinthium,** 94.
White florets; leaves thrice pinnatifid................ **Achillea,** 94.
White florets; leaves connate-perfoliate............... **Eupatorium,** 95.
Yellow ray florets; leaves sessile, spatulate to lanceolate. **Grindelia,** 96.
Yellow florets; leaves linear-lanceolate................ **Solidago,** 97.
Yellow tubular florets; leaves alternate, pinnatifid..... **Tanacetum,** 97.

Gentianeæ:

Two nectaries on each petal.......................... **Chirata,** 99.

Labiatæ:

Upper lip arched; stamens 4......................... **Cataria,** 100.
Corolla small, 2-lipped; stamens 2.................. **Hedeoma,** 101.
Flowers in axillary whorls; stamens 2.............. **Lycopus,** 101.
Flowers in corymbose clusters; stamens 4............ **Majorana,** 102.
Flowers in dense, woolly, axillary whorls; stamens 4... **Marrubium,** 103.
Flowers in small cymes; stamens 4.................. **Melissa,** 103.
Flowers in obtuse spikes; stamens 4, short............ **Mentha ppt.,** 104.
Flowers in slender spikes; stamens 2............... **Menth. virid.,** 104.
Corolla long, with narrow lip; stamens 2............ **Monarda,** 105.
Flowers in axillary 1-sided racemes; stamens 4........ **Scutellaria,** 106.

Leguminosæ:

Leaves usually absent; stamens monadelphous........ **Scoparius,** 106.

Lobeliaceæ:

Leaves alternate; stamens united into a tube.......... **Lobelia,** 107.

Papaveraceæ:

Flowers in long-peduncled umbels; capsule linear.... **Chelidonium,** 109.

Ranunculaceæ:

Rhizomes filiform, golden-yellow..................... **Coptis,** 110.
Cluster of leaves forming an involucre some distance
below the flower.............................. **Pulsatilla,** 111.

Solanaceæ:

Gray-brown hairy leaves, irregularly lobed; flowers, or capsules within persistent calyx, often present.... **Hyoscyamus**, 113.

Urticaceæ:

Flowers consisting of single sepal inclosing pistil or capsule .... **Cannabis**, 114.

Group X

Algæ

Thallus filiform, much branched, horny, translucent... **Chondrus**, 117.
Thallus with large air-vesicles....................... **Fucus**, 119.
Thallus round or oval, tough and horny, long, stem-like. **Laminaria**, 120.
Mixture of several small sea-weeds.................. **Corsican Moss**, 120.

Group XI

Lichens

Irregularly lobed lichens, brownish-gray above and grayish-white below .... **Cetraria**, 121.
Flat lichen, brownish, with oval prominences on one side and corresponding depressions on the other side. **Sticta**, 122.

Group XII

Fungi

Fusiform, purplish-black grains...................... **Ergota**, 123.
Irregular, brown-black masses, partly membranous, partly pulverulent .... **Ustilago**, 125.
White, tough, light masses.......................... **Agaricus**, 126.
Thin, brown, pliable, velvety sheets.................. **Spunk**, 126.
Semi-fluid, viscid, frothy substance.................. **Yeast**, 126.
White or yellowish grains........................... **Kefir-seed**, 127.
Round dark-brown masses, pulverulent within......... **Puff-balls**, 127.

Group XIII

Lycopodiaceæ

Light-yellow, very mobile powder.................... **Lycopodium**, 128.

Group XIV

Equisetaceæ

Jointed, hollow, slender stems, about 60 cm. long; or broken .... **Equisetum**, 129.

Group XV

Ferns

Large rhizome beset with the bases of stipes.......... **Aspidium,** 130.
Frond of fern with triangular leaflets and thin, glossy brown stipes .... **Adiantum,** 131.
Hard, dark-brown rhizome, beset with short remnants of stipes .... **Polypodium,** 132.
Fine, silky, glossy, bronze-colored hairs............... **Penghawar,** 133.

Group XVI

Endogenous Roots

Very long, about 4 to 5 mm. thick; brownish........ **Sarsaparilla,** 162.
Thin and slender, about 15 to 20 cm. long, and about 1 mm. thick .... **Vetiveria,** 168.

Group XVII

Woody Exogenous Roots With Thin Bark

Brown or purplish brown; wood tough .... **Krameria,** 169.
Blackish-brown and warty; wood in irregular circles or rings .... **Pareira,** 170.
Wood firm and yellow; taste very sweet.............. **Glycyrrhiza,** 172.
Yellowish-brown; tough yellowish wood.............. **Gelsemium,** 173.
Large, grayish-brown; often with rootlets braided; or chopped in pieces .... **Methysticum,** 175.
Thin pale brown bark, often scaling off and showing white wood .... **Hydrangea,** 176.

Group XVIII

Woody Exogenous Roots With Thick Bark; With Ducts

Long roots, gray bark about one-fourth of diameter of the dry root .... **Apocynum Cannabinum,** 177.
Similar to above, but thinner, brown, and bark about one-sixth of entire thickness..................... **Apocynum Androsæmifolium,** 178.
Short brownish-gray sections, wood spongy and bark easily separable and flaring at cut ends.......... **Stillingia,** 180.

Group XIX

Woody Exogenous Roots With Thick Bark; No Ducts

Purplish-brown, wood tough, bark thick.............. **Krameria,** 181.
Small roots, blackish-brown, with thick annulated bark. **Ipecacuanha,** 181.

Group XX

Fleshy Roots With Ducts

Group XXI

Fleshy Roots Without Ducts

White roots, with cork removed, white, mealy and fibrous .... **Althæa**, 206.
Longitudinal and transverse sections, with projecting white wood-bundles alternating with yellowish-gray parenchyma .... **Phytolaccæ Radix**, 207.
Long, simple, fusiform root, usually partially broken and doubled up lengthwise .... **Rumex**, 208.
Brown-black, horny, somewhat contorted roots, often split lengthwise .... **Symphytum**, 209.
Long, thin roots, externally rust-brown, internally whitish .... **Saponaria**, 209.
Cylindrical, simple, fleshy root, grayish-brown and wrinkled .... **Lappa**, 210.
Crowned with leaf-bases and covered with a dark purplish foliaceous bark easily separable from the yellowish wood .... **Alkanna**, 211.
Longitudinal or transverse slices, pale orange-brown... **Frasera**, 212.

Group XXII

Endogenous Rhizomes With Rootlets

Long, grayish or brownish, deeply wrinkled roots, often over 1 meter long, folded back over a compact rhizome .... **Sarsaparilla**, 215.
Obconical, blackish-gray, with shriveled lighter-colored rootlets .... **Veratrum Viride**, 215.
Thin, branched, straw-colored or pale yellowish, with hair-like rootlets at nodes .... **Convallaria**, **216**.
Jointed, deeply-wrinkled, flattish, grayish-brown, annulated with darker-colored markings........ **Iris Versicolor**, 217.
Obconical to subglobular, annulate, orange-brown..... **Trillium**, 217.
Obconical, grayish-brown, with rootlets on upper part; whitish within .... **Dracontium**, 218.
Bent, orange-brown, with many stem-scars above and wavy rootlets below .... **Cypripedium**, 219.
Whole, or longitudinal slices, yellowish-brown, whitish within; annulate .... **Polygonatum**, 220.
Much branched and curved; pale-brown, very hard and tough .... **Dioscorea**, 221.
Subcylindrical, curved, grayish-brown, with tough, wiry rootlets .... **Helonias**, 222.
Cylindrical, covered with tufts of leaf-bases and numerous pale-colored and soft rootlets........ **Aletris**, 222.
Flattish-cylindrical, reddish-brown, with root-scars in wavy lines on under side........ **Calamus**, 223.

Group XXIII

Exogenous Rhizomes With Rootlets; With Ducts

Small, hard, dark-brown, curved rhizome; rootlets all on lower side; a ring of ducts in the section.......... **Arnica**, 224.

Short, thick, upright rhizome, with many rootlets; with characteristic odor .... **Valeriana**, 224.

Thin, small rhizome, with remains of stems on upper side, and many rootlets on lower side............. **Serpentaria**, 226.

Group XXIV

Exogenous Rhizomes With Rootlets; No Ducts

Short, thick, upright rhizome with many rootlets; with characteristic odor .... **Valeriana**, 228.

Thin, small rhizome with remains of stems on upper side, and many rootlets on lower side............ **Serpentaria**, 228.

Small, thin, knotty rhizomes, with many brittle rootlets, gamboge-colored within................... **Hydrastis**, 228.

Irregular, knotty, brownish-black rhizomes, with many rootlets which have from 3 to 6 radiating bundles.. **Cimicifuga**, 229.

Small, knotty rhizome, with several stem-scars and numerous long rootlets; grayish-brown............. **Spigelia**, 230.

Hard, irregular, bent and knotty rhizome, with broad stem-scars and numerous rootlets; yellowish-brown. **Caulophyllum**, 230.

Rhizome a meter or more long, with small rootlets; brown or yellowish-brown .... **Menispermum**, 231.

Knotty, many-headed caudex with many rootlets; grayish or yellowish-brown externally and with white wood .... **Asclepias Incarnata**, 232.

Blackish-brown, branched and flattened rhizome, with many and long nearly black rootlets.............. **Leptandra**, 233.

Thin, long, more or less contorted rhizomes; purplish-brown externally and whitish within............. **Asarum**, 234.

Much contorted, tough, knotty rhizomes, with several stems and more or less contorted roots; light-brown externally and white within..................... **Gillenia**, 235.

Knotty, scaly and wrinkled rhizome, with rootlets on under side; brownish externally and whitish within .... **Geum**, 236.

Very hard, knotty and irregularly branched rhizomes, with thin and brittle rootlets; grayish-brown...... **Collinsonia**, 237.

Group XXV

Cryptogamous Rhizomes Without Rootlets

Large rhizome, beset with the bases of stipes.......... **Aspidium**, 237.
Hard, dark-brown rhizome, beset with short remnants of stipes .... **Polypodium**, 237.

Group XXVI

Endogenous Rhizomes Without Rootlets; Elongate

Jointed, deeply-wrinkled, flattish, grayish-brown, annulate with darker-colored markings................ **Iris Versicolor**, 238.
Flattish-cylindrical, reddish-brown, with root-scars in wavy lines on the under side.................... **Calamus**, 238.
Very long, thin, straw-colored, hollow; usually cut into pieces about 1 cm. long......................... **Triticum**, 240.

Group XXVII

Endogenous Rhizomes Without Rootlets; Short

Flattish, lobed, peeled or unpeeled, brownish, gray or white rhizomes .... **Zingiber**, 241.
Cylindrical, branched, reddish-brown rhizomes, annulate with lighter-colored wavy leaf-sheaths............ **Galanga**, 243.
Cylindrical or oval yellowish-gray rhizomes, deep orange-yellow within .... **Curcuma**, 244.
Flat, somewhat ham-shaped, grayish or white rhizomes, often with similarly shaped smaller lobes attached. **Iris Florentina**, 245.
Very hard, irregular, massive tuberous rhizomes, reddish-brown, with funnel-shaped stem-scars .... **Chinæ Rhizoma**, 246.
Light-reddish or brownish-gray circular disks, or in longitudinal halves or quarters.................. **Zedoaria**, 247.
Subcylindrical, curved, grayish-brown rhizome without rootlets .... **Helonias**, 248.

Group XXVIII

Exogenous Rhizomes Without Rootlets; Elongate

Rhizome with thickened nodes, with stem-scars above and root-scars below, glossy brown.............. **Podophyllum**, 248.
Cylindrical, annulate, light, pithy, grayish-brown, bark exfoliating .... **Aralia Nudicaulis**, 249.

Group XXIX

Exogenous Rhizomes Without Rootlets; Short

Flattened, bent upon itself, or broken, dark-brown, hard. **Bistorta,** 250.
More or less curved and somewhat flattened pieces, with closely set, large cup-shaped stem-scars; brownish. **Scopola,** 251.
Dark reddish-brown rhizome, somewhat flattened, much wrinkled and twisted .... **Sanguinaria,** 252.
Hard, compact, contorted and tuberculated, umber-brown .... **Geranium,** 252.
Simple, cylindrical or flattened, externally rough and grayish-brown .... **Tormentilla,** 253.
Dark-brown, knotty, flattened, with root-scars and transverse rings .... **Imperatoria,** 254.

Group XXX

Whole Tubers and Corms

Hard, tuberous, irregularly round or pear-shaped, dark-brown .... **Jalapa,** 255.
Conical, blackish-brown, tuberous roots, single or joined in pairs .... **Aconitum,** 255.
Ovoid, brownish, wrinkled corms, with a groove on one side .... **Colchicum,** 255.
Single, round, small, hard, semi-translucent or opaque, yellow or brown tubers; sometimes two concavo-convex tubers joined, with a third smaller tuber between them .... **Corydalis,** 256.
Oval, slightly flattened or shrunken, semi-translucent and very hard .... **Salep,** 256.

Group XXXI

Sliced Tubers

Kidney-shaped grayish-white slices .... **Colchicum,** 257.
Transverse slices with dark-gray epidermis and mealy-white surfaces .... **Arum,** 259.

Group XXXII

Whole Bulbs

Large, juicy, greenish or pinkish-white bulbs, the external scales, when present, pinkish-brown .... **Scilla,** 260.
White bulbs, with stem, coated with a few dry, membranous, white scales enclosing about eight bulblets. **Allium,** 261.

Group XXXIII

Sliced Bulbs

Narrow slices, up to 5 cm. long, often contorted; whitish with yellowish or pinkish tint; slightly diaphanous .... **Scilla**, 262.

Group XXXIV

Leafy Twigs

Twigs with obovate or oval, coriaceous, slightly serrate leaves .... **Gaultheria**, 263.

Twigs mixed with coriaceous, oblanceolate or cuneate-lanceolate leaves, with margin serrate at apex and entire near the base .... **Chimaphila**, 265.

Twigs and leaves agglutinated into broken masses with exuded gum-resin; leaves lanceolate, dentate .... **Eriodyction**, 266.

Brownish-green twigs with oval, thick coriaceous, and deeply wrinkled leaves; leaves usually detached from twigs .... **Phoradendron**, 267.

Twigs with scythe-shaped long, light-grayish-green leaves. **Eucalyptus**, 354.

Group XXXV

Scaly Twigs

Scales with a longitudinal ridge and projecting gland.. **Thuja**, 268.

Scales with a longitudinal groove .... **Sabina**, 269.

Group XXXVI

Naked or Leafless Twigs

Short, pale, grayish-green pieces of twigs, with smooth-cut ends; usually hollow .... **Dulcamara**, 270.

Pale-green, five or six-angled stems, with clusters of spines on the edges .... **Cereus**, 271.

Group XXXVII

Piths

Slender, cylindrical, sometimes curved pieces, spongy white .... **Sassafras Medulla**, 273.

Similar to above, but thicker and yellowish in color.... **Sambuci Medulla**, 273.

Group XXXVIII

White Woods

Coarse, light, white shavings, or raspings............. **Quassia**, 276.

Group XXXIX

Colored Woods

Greenish-brown raspings, mixed with some white particles .... **Guaiaci Lignum**, 278.
Yellowish or reddish-gray raspings................... **Juniperi Lignum**, 279.
Deep purplish-red or brownish-red shavings, or coarse powder .... **Santalum Rubrum**, 280.
Red or reddish-brown raspings, the cut surfaces having resinous appearance .... **Fernambuco**, 280.
Purplish-black or brownish-red shavings or raspings, often with a greenish-metallic luster .... **Haematoxylon**, 281.
Brown or yellowish-brown chips or raspings.......... **Lignum Citrinum**, 282.

Group XL

Cinchona Barks; Bark With Isolated Bast-Cells

Quills or troughs with brownish-gray cork; brownish-yellow internally .... **Cinchona Flava**, 303.
Thick, flat pieces, usually without cork, splintery, fibrous, orange-yellow .... **Cinchona Flava**, 304.
Two kinds, flat and quilled; similar to above kinds, except that color is deep reddish-brown.............. **Cinchona Rubra**, 305.
Quills, smaller than other varieties, grayish-brown externally and internally........................... **Cinchona Pallida**, 306.

Group XLI

Barks With Bast Radially Striate

Troughs or simple quills, without cork, both surfaces cinnamon-brown; pungently aromatic............. **Cinnamom. Cass.**, 308.
Thin, papery, compound quills, without cork, externally and internally pale cinnamon-colored; pungently aromatic .... **Cinnamom. Zeyl.**, 309.

Large troughs or quills, externally with grayish-brown cork, internally cinnamon-brown; pungently aromatic .... **Cinnamom. Saigon.**, 310.

Quills or irregular pieces, dull brownish, with peculiar transverse cracks and with white lichens with black spots on outer surface; taste bitter aromatic...... **Cascarilla**, 311.

Irregularly curved pieces, cork removed, both surfaces reddish-brown with a shade of carmine; longitudinally striate, fracture short and pale-pink or whitish; bitter astringent........ **Cornus**, 312.

Quills or broken pieces, externally whitish or pale-reddish with white scars, internally whitish; odor cinnamon-like and taste pungently bitterish.......... **Canella**, 313.

Irregular pieces, outer surface often marbled, fragile, soft, rust-brown, with characteristic taste and odor. **Sassafras**, 314.

Quills or flat pieces, externally purplish-brown, showing small transverse scars, or rough; internally longitudinally fissured; developing bitter almond taste on chewing .... **Prunus Virg.**, 315.

Long, coarsely fibrous, pale yellowish-brown pieces, often partially broken and folded upon themselves; bitter. **Simaruba**, 317.

Quills or troughs, externally dark brownish-gray with corky warts, internally orange-brown with narrow, short, longitudinal ridges; bitter astringent........ **Alnus Rubra**, 317.

Shallow troughs and irregular fragments, cork removed, toughly fibrous internally; both surfaces yellowish-brown .... **Magnolia**, 318.

Troughs or quills, purplish-brown externally, internally yellowish-white, fibrous in inner layer; bitter astringent .... **Liriodendron**, 319.

Thin, tough, flexible bands, flattish or quilled, outer surface blackish, inner pale-brown; mixed with small roots .... **Rubus**, 320.

Thin fragments, outer surface brownish, inner surface yellow; bitter; stains saliva yellow............... **Berberis**, 321.

Irregular pieces, outer surface pale yellowish-brown with lighter spots, inner surface smooth and brownish-yellow; fracture abrupt, almost waxy......... **Ptelea**, 322.

Quills or troughs, brownish-gray with whitish patches, marked with minute black dots and scattered small spines; striation obscure........ **Xanthoxylum, N.**, 345.

Group XLII

Barks With Bast Tangentially Striated

Nearly flat massive bark, with thick corky layer deeply fissured; gray or grayish-brown on outer and reddish on inner surfaces.......................... **Aspidosperma**, 324.

Thin flexible bands or quilled pieces; brownish on outer and whitish on inner surfaces; separable into thin layers .... **Gossypii Rad. Cort.**, 326.

Long, thin, flexible bands, rolled into bundles, yellowish on outer and silky-white on inner surfaces......... **Mezereum**, 327.

Quilled pieces or troughs; ash-gray outer and whitish or pale tawny inner surfaces.................... **Euonymus**, 328.

Flattish pieces or troughs; ash-gray outer and pale-brown or whitish inner surfaces.................. **Viburnum Opulus**, 329.

Thin quills or troughs, gray-brown outer and pale-brown and striated inner surfaces...................... **Cundurango**, 330.

Small contorted quills or troughs, usually irregularly broken; occasionally whole pieces of root; their brownish corky layer usually partially detached and adherent in shreds............................. **Rhois Glabræ Cort.**, 331.

Large troughs or flat pieces, smooth, dark-brown and mottled on outer surface; bork generally absent.. **Juglans (stem)**, 332.

Coarse quills, troughs or irregular pieces, toughly fibrous; outer surface gray or blackish-brown with many transverse ridges, inner surface smooth or fibrous.. **Piscidia**, 333.

Thick quills or troughs with coarsely fissured grayish-brown corky layer, or without bork; yellowish-brown and striated inner surface................ **Alstonia Constr.**, 334.

Group XLIII

Barks With Quadratically Striated Bast

Thin, tough quills, glossy greenish or yellowish-brown outer surface; bitter astringent.................. **Salix**, 336.

Flat, pale brownish-white pieces with corky layer removed; mucilaginous taste...................... **Ulmus**, 337.

Large, flat pieces or troughs, reddish-brown externally; fibrous fracture; acrid taste.................... **Quillaja**, 337.

Quills or troughs, cork warty, ash-gray, or wanting; fracture splintery, coarsely fibrous............... **Fraxinus**, 338.

Large troughs or flat pieces, smooth, dark-brown and mottled on outer surface; bork generally absent.. **Juglans**, 332.

Brittle pieces or small quills, externally yellowish-gray, inner surface somewhat darker; often with conchoidal depressions externally.................. **Granatum**, 347.

Group XLIV

Barks With no Striation in Bast

Heavy, long, flattish pieces or troughs, the bark up to 15 mm. thick, reddish-brown.................... **Coto**, 340.

Similar to above, rust-brown, outer surface fissured and shrunken .... **Paracoto**, 340.

Narrow, brittle fragments, shaved from twigs, about 1 mm. thick, whitish wood adhering to inner surface .... **Prinos**, 341.

Irregular pieces or troughs, outer surface grayish-brown with transverse warts, or reddish-brown patches where grayish-brown cork is detached.......... **Hamamelidis Cortex**, 342.

Troughs or quills, up to 30 cm. long, younger bark mottled, older with rough cork................ **Cascara**, 343.

Thin bark in rolled quills, externally grayish-brown to blackish-brown with small transverse whitish cork-warts; inner surface brownish yellow........ **Frangula**, 344.

Thin quills or troughs, glossy purplish-brown with scattered warts and blackish dots................ **Viburnum prun.**, 345.

Quills or troughs, brownish-gray with whitish patches, marked with minute black dots and scattered small spines; obscure radial striation................. **Xanthoxyl., N.**, 345.

Quills or flattish pieces, brownish-gray with many large conical projections. .... **Xanthoxyl., S.**, 346.

Irregular pieces or troughs, externally brown and rough from warts; inner surface pale brownish-yellow.. **Chionanthus**, 347.

Brittle pieces or small quills, externally yellowish-gray, inner surface somewhat darker; often with conchoidal depressions externally................. **Granatum**, 348.

Irregular pieces, outer surface marbled or grained, fragile, soft, rust-brown; characteristic odor and taste .... **Sassafras**, 314.

Irregular pieces, outer surface pale yellowish-brown with lighter spots, inner surface smooth and brownish-yellow; fracture abrupt, almost waxy.. **Ptelea**, 322.

Group XLV

Rasped Barks

An irregular coarse, grayish-brown powder mixed with many tough coarse fibers....................... **Quercus Alba**, 349.

Group XLVI

Leaf Buds

Long, tapering, scaly leaf buds, brown and covered externally with sticky resinous exudation....... **Populi Gemmae**, 350.

Group XLVII

Simple Coriaceous Leaves

Scythe-shaped, 15 to 30 cm. long, margin entire; grayish-green .... **Eucalyptus**, 354.
Roundish-obovate, about 15 mm. long, margin crenate or serrate; yellowish-green; pellucid-punctate, with a gland at each serration...................... **Buchu (short)**, 355.
Slender, linear-lanceolate leaves, about 3 to 4 cm. long, margin serrate; otherwise like the preceding.... **Buchu (long)**, 356.
Obovate or oblong-spatulate, 15 to 20 mm. long, margin entire; lower surface reticulate; brownish-green .... **Uva Ursi**, 356.
Variable in size and shape, ovate, obovate-oblong to lanceolate, 2 to 7 cm. long, margin entire; green to brownish; with a curved line on each side of the midrib .... **Coca**, 357.
Obovate to oblong, 10 to 25 mm. long, margin with 2 to 6 dentations on each side; light-green........ **Damiana**, 358.
Ovate-oblong, to 5 cm. long, with long petiole, margin finely crenulate; whitish to grayish-green, downy.. **Salvia**, 359.
Rolled into small balls or cylinders, grayish-green, bluish-green to blackish........................ **Thea**, 359.
Oblong or oblong-lanceolate, acute at both ends, 5 to 10 cm. long, margin entire, somewhat wavy; pellucid-punctate; brownish or brownish-green....... **Laurus**, 361.
Broadly oval, about 5 cm. long, margin entire; rough on both sides, glossy on upper and hairy on under surfaces; brownish-green .... **Boldus**, 361.
Linear, about 25 mm. long, margin revolute, dark-green above, whitish woolly, glandular, with prominent midrib underneath .... **Rosmarinus**, 362.
Lanceolate, short-petiolate, 7 to 10 cm. long, to 25 mm. broad, margin entire and somewhat wavy; thin, smooth, and often with scars from insects... **Duboisia**, 362.
Ovate, petiolate, about 5 cm. long, margin entire; thick, glaucous, pale green.......................... **Manzanita**, 363.
Roundish-oval or obovate, about 4 cm. long, 2 or more cm. broad, margin slightly serrate with appressed spicular teeth; smooth, glossy, green or brownish-green .... **Gaultheria**, 263.

Oblanceolate, about 5 cm. long, margin serrate at apex and nearly entire near base; smooth, dark green.. **Chimaphila**, 265.

Oblong-lanceolate, 5 to 10 cm. long, margin irregularly dentate; greenish or brown; upper surface smooth and covered with brownish resin, lower surface white-hairy .... **Eriodyction**, 266.

Group XLVIII

Compound Coriaceous Leaves

Whole leaf with 8 to 10 leaflets; leaflets various sizes, 2 to 4 cm. long, lanceolate, uneven at base, entire, grayish-green .... **Senna**, 364.

Whole leaf with 5 to 11 leaflets; leaflets about 10 to 15 cm. long, oval or ovate-oblong, emarginate, uneven at base, margin entire, pellucid-punctate, dull grayish-green .... **Pilocarpus**, 366.

Group XLIX

Simple Herbaceous Leaves

Broadly ovate, thin, smooth, 5 to 15 cm. long, petiolate, apex tapering, margin entire; usually as "tops" with two unequal leaves at nodes........ **Belladonnæ Folia**, 368.

Ovate, 10 to 30 cm. long, petiolate, margin crenate, reticulate on under surface, densely hairy...... **Digitalis**, 369.

Lanceolate, about 10 to 15 cm. long, apex acute, base unequally cordate, margin finely crenulate, under surface with prominent venation and deeply reticulate .... **Matico**, 371.

Obliquely ovate or oval, about 10 cm. long, short petiolate, margin irregularly sinuate or wavy-toothed.. **Hamamelis**, 372.

Ovate to oblong lanceolate, acuminate, petiolate, 15 to 25 cm. long, from 5 to 8 cm. broad, evenly feather-veined, margin serrate........ **Castanea**, 372.

Ovate, petiolate, about 15 to 25 cm. long, margin irregularly sinuously lobed or toothed, much wrinkled and broken........ **Stramonii Folia**, 373.

Oblong or oval-lanceolate, 10 to 30 cm. long, petiole broadly winged, apex acute, margin crenate, grayfelty or hairy........ **Verbasci Folia**, 374.

Large peltate leaf, about 9-lobed, up to 50 cm. or more across, lobes acuminate, margin serrate, much wrinkled and broken............................**Ricini Folia**, 375.

Oval or ovate, lanceolate, up to 50 cm. long, apex acute, margin entire, brown....................**Tabacum**, 375.

Rolled into small balls or cylinders; grayish-green, bluish-green to blackish........................**Thea**, 259.

Ovate, irregularly lobed leaves, up to 25 cm. long, gray-green, hairy; usually as leafy tops; flowers or capsules within persistent calyces often present.**Hyoscyamus**, 113.

Frond of fern with triangular leaflets, with sporangia under recurved edges of lobes, and thin glossy-brown stripes ....**Adiantum**, 131.

Group L

Compound Herbaceous Leaves

Trifoliate, with long petiole, side-leaflets nearly sessile, leaflets entire or irregularly lobed........ ..**Rhus Radicans**, 377.

Outline round or subcordate, petiolate, 5 to 10 cm. in diameter, 3 to 5-parted, the lobes deeply incised and wedge-shaped ....**Aconiti, Folia**, 378.

Large, broad leaves, with hollow petiole, twice or thrice decompound ....**Conii Folia**, 379.

Long petioled, bi or tri-pinnately decompound; lobelets entire, spatulate, somewhat fleshy................**Ruta**, 380.

Group LI

Racemose or Cymose Inflorescences

Large panicles in bundles, rolls or compressed clusters; reddish-brown ....**Cusso**, 382.

Bundles of one-sided racemes with about eight or nine bell-shaped flowers; scape about 15 cm. long......**Convallariae Flores**, 383.

Heads of small, reddish, papilionaceous flowers, with foliage leaves at base..........................**Trifolium**, 384.

Pale yellowish-green bracts with cymes of three to nine flowers ....**Tilia**, 385.

Large corymbose cymes of yellowish color............**Sambucus**, 395.

Group LII

Unopened Compound Flower-Heads

Elongate, somewhat angular, scaly flower-heads, 2 to 3 mm. long, grayish-green; unopened............**Santonica**, 386.

Group LIII

Expanded Compound Flower-Heads

Heads about 3 cm. broad, with scaly involucre, flat receptacle, about 15 to 20 yellow ray-florets and many disk-florets with pappus.................. **Arnicæ Flores**, 388.
Subglobular heads, about 2 cm. broad, with imbricate involucre, conical solid receptacle, numerous white ligulate florets and few disk-florets.............. **Anthemis**, 389.
Heads about 2 cm. broad, with imbricate involucre, conical hollow receptacle, 12 to 18 white ray-florets and many deep-yellow disk-florets................ **Matricaria**, 390.
Heads depressed roundish, about 2.5 cm. broad, with imbricate involucre, convex receptacle, about 20 to 30 pinkish ray-florets and numerous yellow disk-florets .... **Pyrethri Flores**, 391.
Heads subglobular, about 4 to 8 mm. broad, with imbricate involucre, convex receptacle, and numerous yellow tubular florets....................... **Tanacetum**, 97.

Group LIV

Unopened Single Flowers

Subcylindrical calyx tube with four teeth, terminated by a corolla forming a globular head; about 15 mm. long; brown............................... **Caryophyllus**, 392.
Ovoid buds, about 12 to 15 mm. long, with 5-toothed calyx; pale brownish-yellow................... **Aurantii Flores**, 393.

Group LV

Opened Single Flowers

Simple Flowers:
Small shriveled, pale brownish-yellow, roundish grains. **Sambucus**, 395.
Small two-lipped flowers with bluish-gray calyx and violet-blue corolla .... **Lavandula**, 396.
Light grayish-green, double calyx, felty with stellate hairs; petals purplish-black..................... **Althææ Flores**, 396.
Similar to last, somewhat smaller, and the corolla bluish-purple in dry drug......................... **Malvæ Flores**, 397.
Calyx grayish-green, felty, 5 parted; corolla 5-lobed, wheel-shaped, yellow .... **Verbasci Flores**, 403.

Florets from Compound Flowers:
Yellow, strap-shaped, fertile (female) ray-florets...... **Calendula**, 398.
Deep-red, thin tubular, 5-lobed corolla, with projecting anther tube and style......................... **Carthamus**, 399.
Neuter (sexless) florets, with tubular corolla ending in 7-parted blue limb.......................... **Cyani Flores**, 400.

Group LVI

Corollas

Roundish-obovate or obcordate petals of pinkish color and fragrant odor .... **Rosa Centifolia**, 401.
Deep purplish-red cones, about 2.5 cm. long, consisting of imbricated roundish petals .... **Rosa Gallica**, 402.
Five-lobed, wheel-shaped, hairy, yellow corolla, with five coherent anthers enclosed .... **Verbasci Flores**, 402.
Nearly round, thin, dark-red petal, about 5 cm. broad, with a blue-black spot at the base .... **Rhœadis Flores**, 403.
Five obovate-cuneate, deep-red to purplish-black petals, each about 2.5 to 4 cm. long, united at the base .... **Althææ Flores**, 396.
Similar to last, but smaller and bluish-purple .... **Malvæ Flores**, 397.
Deep-red, thin tubular, 5-lobed corolla, with projecting anther tube and style .... **Carthamus**, 399.
Neuter (sexless) florets, with tubular corolla ending in 7-parted blue limb .... **Cyani Flores**, 400.

Group LVII

Stigmas

Separate stigmas, or three attached to a style, linear-tubular, about 3 cm. long, deep orange-brown with reddish tinge .... **Crocus**, 405.
Tufts of soft, silky, thread-like, yellowish hairs, about 15 cm. long; the ends of the tufts often dried or shriveled together and dark-brown .... **Zea**, 407.

Group LVIII

Fresh Spurious Fruits

Pitcher-shaped or ovate berry-like fruit, about 2 cm. long, bright glossy red, bristly hairy within .... **Rosa Canina**, 409.
Globular or subglobular pome; green, russet, yellow, red or varicolored; acidulous sweet .... **Malum**, 410.

Group LIX

Fresh Fleshy Fruits

Oval, bright yellow fruits, with very acid juice .... **Limon**, 412.
Globular or subglobular, orange-colored fruits, with acidulous sweet juice .... **Aurantii Fructus**, 413.
Globular green berry, about 2.5 cm. in diameter, with 4-lobed persistent calyx and about five seeds .... **Diospyros**, 414.

Globular or subglobular pome; green, russet, yellow, red or varicolored; acidulous sweet.............. **Malum,** 410.

A collective or multiple fruit, composed of numerous small drupes; red or black...................... **Rubus Idaeus,** 415.

Small round fruit resembling a berry, about 5 mm. in diameter, brownish-black with bluish bloom...... **Juniperus,** 417.

Group LX

Fresh Stone Fruits

Numerous red or black stone-fruits united into a small, round-conical cluster with hollow base; sweet, acidulous .... **Rubus Idaeus,** 415.

Group LXI

Dried or Prepared Spurious Fruits

Strobile with flexible scales; yellowish-green......... **Humulus,** 416.

Small, round fruit resembling a berry, about 5 mm. in diameter, brownish-black with bluish bloom....... **Juniperus,** 417.

Compressed, of irregular shape, fleshy, yellowish-brown; very sweet............................ **Ficus,** 418.

Cylindrical, about 4 to 5 cm. long, 5 mm. thick, spirally nodulated, stalked, grayish-brown............... **Piper Longum,** 420.

Dull greenish or greenish-brown fruit, about 1 mm. in diameter, depressed globular, obscurely lobed, containing a glossy black seed; peculiar odor and pungent taste .... **Chenopodium,** 421.

Group LXII

Dry Fruits

Capsules or Pods:

Small, obtusely triangular, 3-celled capsules, 10 to 15 mm. long; central placenta with many brown seeds; pale buff................................ **Cardamomum,** 426.

Eight reddish-brown woody follicles, arranged star-shaped; often some of the carpels are aborted; odor anise-like .... **Illicium,** 427.

Large, round or elongated, pale brownish-yellow capsules, 1-celled, with many parietal placentas and containing many white or bluish seeds............ **Papaver,** 429.

Fleshy, linear, dark brown pod, up to 25 cm. long by 8 mm. thick; very fragrant...................... **Vanilla,** 430.

Hard, rigid, cylindrical, dark brown pod, up to 60 cm. long by 2.5 cm. thick........................**Cassia Fistula**, 432.
Flat, broad, glossy brownish pod, about 10 to 20 cm. long, with up to 12 seeds; with sweetish pulp....**Ceratonia**, 432.
From 2 to 5 small, somewhat thick and fleshy pods attached to a short stalk; each about 5 mm. long and containing 1 or 2 glossy black seeds.............**Xanthoxyli Fructus**, 433.

AKENES:

Obovate-oblong, brownish-gray, somewhat curved akene, about 6 mm. long......................**Lappæ Fructus**, 434.
Subglobular, brownish or greenish-gray akene, about 4 mm. in diameter, with a single oily seed........**Cannabis Fructus**, 435.
Elliptic grain, about 7 to 9 mm. long, enclosed in straw-colored paleæ; taste farinaceous...........**Hordei Fructus**, 435.
Like preceding in appearance, but with sweet taste...**Maltum**, 436.
Elliptic, flattened, glossy pale yellowish grain, about 4 mm. long.................................**Phalaridis Fructus**, 436.
Very small subglobular utricle, about 2 mm. in diameter; dull greenish-brownish color; contains shining black seed...............................**Chenopodium**, 421.

CREMOCARPS; usually remaining united; *with oil tubes:*

Oval; each fruit with 5 obscure ridges and about 16 oil-tubes; grayish, finely hairy..................**Anisum**, 437.
Globular, hollow, some of the ridges wavy; each fruit with 2 oil-tubes on inner face; brownish-yellow, smooth ....**Coriandrum**, 437.
Elongated, compressed from sides; each fruit with 5 ridges and 6 oil-tubes; yellowish-brown; rough hairy ....**Cumini Fructus**, 438.
Elongated, nearly cylindrical, with 5-toothed calyx, ridges not prominent; each fruit with 6 oil-tubes; brownish-green ....**Phellandrii Fructus**, 438.

Often remaining united; *without oil tubes:*

Oval, compressed from sides; each fruit with 5 nodulated ridges and 2 deep lateral grooves; no oil-tubes; albumen crescent-shaped in transverse section; brownish-green ....**Conium**, 439.

Usually separating; *with oil-tubes:*

Elongated, compressed from sides; each fruit with 5 obscure ridges and 6 oil-tubes; usually curved; brown ....**Carum**, 440.

Elongated, nearly cylindrical; each fruit with 5 angular ridges and 6 oil-tubes; smooth; yellowish-brown.. **Fœniculum**, 440.
Roundish-ovate, compressed from sides; each fruit with 5 obscure ridges and 6 oil-tubes; grayish-green.... **Petroselini Fructus**, 441.
Oval, compressed from back; each fruit with 3 sharp-keeled dorsal ridges and 2 long lateral ridges forming thin broad margins; 6 oil-tubes; brown...... **Anethi Fructus**, 441.
Very small, roundish-ovate, compressed from sides, smooth; each fruit with 5 angular ridges and 12 to 15 oil-tubes; brown........................ **Apii Fructus**, 442.
Elliptic, compressed from back; each fruit with 5 prominent ridges, the lateral ones larger, and 6 oil-tubes; yellowish-brown .... **Levistici Fructus**, 442.
Elliptic, compressed from back; each fruit with 3 prominent dorsal ridges and 2 long, flat, lateral ridges; numerous oil-tubes; yellow.............. **Angelicæ Fructus**, 443.
Oval, compressed from back; each fruit with 7 ridges, 2 lateral and 2 dorsal spinous, and 3 dorsal short-hairy; 6 oil-tubes; grayish-brown................ **Dauci Fructus**, 444.

Group LXIII

Fleshy Fruits, or Berries, Dried or Prepared

Small, wrinkled, black berries, 3 to 4 mm. in diameter; pungently spicy .... **Piper Nigrum**, 446.
Oblong-conical, glossy red berry, about 2 cm. long; taste very hot................................. **Capsicum**, 447.
Very light, spongy, white or yellowish-white, globular fruits, 5 to 10 cm. in diameter; very bitter........ **Colocynthis**, 448.
Soft, shriveled, flattened berries, brownish, translucent; very sweet .... **Uvae Passae**, 449.
Roughly granular, hard, grayish-brown berries with circular scar at base............................. **Aurant. Fr. Immat.**, 450.
Small compound berries with ten carpels, almost black; sticking together in lumps..................... **Phytolaccæ, Fr.**, 451.
Oval-oblong fruits, with 4 cleft calyx; odor clove-like. **Anthophylli**, 451.
Small round fruit resembling a berry, about 5 mm. in diameter, brownish-black with bluish bloom...... **Juniperus**, 417.

Group LXIV

Drupes, Dried or Prepared

Globular, wrinkled, stalked, brownish-black drupe, 3 to 5 mm. diameter; odor and taste spicy.......... **Cubeba**, 452.

Oval, oblong or globular, bluish to blackish drupe, 3 to 4 cm. long; fruit-like odor and sweet taste........**Prunum**, 453.

Oval, occasionally compressed, somewhat angular, brownish black to bluish-black drupe, 1.5 to 3 cm. long and 1 to 1.5 cm. in diameter................**Sabal**, 453.

Roundish, wrinkled, blackish-brown drupe, about 6 mm. in diameter; odorless..........................**Cocculus**, 454.

Obscurely lobed or roundish, wrinkled, black fruit with four brown seeds, 5 mm. diameter; disagreeable odor, bitter taste..............................**Rhamni Cath. Fruct.**, 455.

Globular drupe, 5 mm. in diameter, with 4-toothed calyx, reddish-brown; spicy....................**Pimenta**, 455.

Oval or subglobular drupe, 3 mm. in diameter, densely hairy, crimson; taste acidulous.................**Rhus Glabra**, 456.

Kidney-shaped drupe with grayish-brown rind and black acrid juicy pulp.........................**Anacardium**, 457.

Similar to last, but heart-shaped and darker-brown...**Semecarpus**, 458.

Group LXV

Parts of Fruits

Brownish-black pulp mixed with tough fibers and glossy brown seeds; acidulous vinous odor.......**Tamarindus**, 459.

Globular, about 2 to 3 mm. in diameter, grayish-white; peppery taste ....**Piper Album**, 460.

Rind of fruit, in quarters, dirty brownish-green on outer and dirty white on inner surfaces; fragrant.**Aurantii Amari Cortex**, 461.

Rind of fruit in spiral bands, dirty brownish-green on outer surface, with little whitish parenchyma on inner surface; fragrant........................**Aurantii Amari Cortex**, 461.

Rind of fruit, in quarters, orange-colored on outer, white on inner surfaces; fragrant...............**Aurantii Dulcis Cortex**, 462.

Irregular leathery fragments of reddish-brown rind, some pieces with hard, long, tubular calyx, and most pieces with oval depressions on inner surface; no odor ....**Granati Fructus Cortex**, 463.

Fragments of fruit, hard brownish-gray rind, to the inner side of which dried pulp with seeds adheres; no odor...............................**Belæ Fructus**, 464.

Hard, thick, deep-brown rind, without adhering pulp, with remains of six-rayed stigma and of hard calyx; no odor...............................**Mangostana**, 465.

Rind of fruit in spiral bands, lemon-yellow on outer, white on inner surfaces; fragrant................**Limonis Cortex**, 466.
Oval grains, about 3 to 4 mm. long, yellowish-white, whiter at ends, yellowish-brown groove along one side ....**Hordeum Perlatum**, 466.

Group LXVI

Whole Seeds

Large Seeds; *with well-marked albumen:*

Oval, about 2.5 cm. long, netted-veined, with white markings from lime-dust, marbled within.........**Myristica**, 472.
Round, flat, disc-like seeds, about 2.5 cm. in diameter and 4 mm. thick; gray and very hard............**Nux Vomica**, 473.
Irregularly ovate and angular, about 3 cm. long, brownish-black and very hard........................**Ignatia**, 474.
Short rounded cone with flattened base; about 2.5 cm. long; brownish with network of reddish veins; heavy, hard ....**Areca**, 475.

Little or no albumen; two cotyledons:

Ovate, flattened, pointed above, obtuse below; 2 to 2.5 cm. long; externally brown, white within; agreeable nut-like taste.............................**Amygdala, Dulcis**, 476.
Appearance like last, but taste bitter with flavor of oil of bitter almonds..............................**Amygdala Amara**, 476.
Oblong, somewhat kidney-shaped, 2.5 to 3 cm. long; chocolate brown, with broad black groove on convex side ....**Physostigma**, 477.
Oval, about 2 to 2.5 cm. long; with thin, fragile, reddish-brown shell..............................**Theobroma**, 478.
Oblong, 4 to 5 cm. long; blackish-brown, wrinkled; odor vanilla-like ....**Dipterix**, 479.
Oval, flat, about 1.5 cm. long; black, brownish-black or pale yellowish-brown with black edges........**Citrullus**, 480.
Oval, flat, about 2 cm. long; whitish.................**Pepo**, 481.
Oblong-lanceolate, obtusely two-edged, 1.5 to 2.5 cm. long; grayish-green, silky hairy..................**Strophanthus**, 481.

Medium-sized Seeds; *with well-marked albumen:*

Plano-convex, oval, grooved on flat side; about 1 cm. long; greenish-brown ....**Caffea**, 482.
Flattish-tetrahedral, about 5 to 7 mm. long, externally reticulately ridged; brownish...................**Staphisagria**, 483.

Lanceolate, angular, about 6 mm. long, 1.5 to 2 mm. thick at thickest end; glossy brownish-black; often mixed with the 3-celled capsules................**Sabadilla**, 484.

Little or no albumen; two cotyledons:

Ovate or ovate-oblong, triangularly compressed, about 8 mm. long; brown, with grayish epithelial scales; mucilaginous ....**Cydonium**, 485.

Oblong-lanceolate, flat, thin, sharply two-edged, about 10 to 12 mm. long; whitish......................**Cucumis**, 486.

Subglobular, about 6 to 8 mm. in diameter; scarlet-red with black spot............................**Abrus**, 486.

SMALL SEEDS; *well-marked albumen:*

Angular, often adhering to one another; about 3 mm. long; brownish-yellow ....**Cardamomi Semen**, 487.

Obovate or nearly globular, finely pitted, 1 to 2 mm. in diameter; reddish-brown.....................**Colchici Semen**, 488.

Kidney-shaped, flattened, pitted, about 3 mm. long; brownish-black ....**Stramonii Semen**, 488.

Kidney-shaped, flattened, reticulately wrinkled, 1 to 1.5 mm. long; gray or yellowish-gray............**Hyoscyami Semen**, 489.

Very small seeds, about 0.75 mm. long, oblong, reticulated, brownish; acrid..........................**Lobeliæ Semen**, 489.

Kidney-shaped, reticulately wrinkled, pitted, about 1 mm. long, yellowish-white.......................**Papaveris Semen**, **490**.

Angular, obscurely tetrahedral, roughly nodulated or warty, about 1.5 to 2 mm. long; black............**Delphinium**, 490.

Globular, about 2 to 3 mm. in diameter, grayish or dirty white; peppery taste......................**Piper Album**, 460.

Little or no albumen; two cotyledons:

Oblong-ovate, flattened, 4 to 5 mm. long; glossy brown ....**Linum**, 491.

Almost globular, finely pitted, with circular hilum; about 1 mm. in diameter; reddish-black.........**Sinapis Nigra**, 492.

Almost globular, finely pitted, with circular hilum; about 1.5 to 2 mm. in diameter; yellowish........**Sinapis Alba**, 493.

Almost globular, nearly smooth; about 2 to 2.5 mm. in diameter; bluish or brownish-black..............**Semen Rapæ**, 493.

Oblong-angular, almost cubical, with a projection on one side; about 3 to 4 mm. long and about 2 mm. broad; brownish ....**Fœnum Græcum**, 494.

Group LXVII

Cotyledons or Seed Leaves

Ovate, fleshy, plano-convex cotyledons about 2.5 to 3 cm. long and half as broad; yellowish............**Quercus Semen**, 495.
Elongated, fleshy; plano-convex cotyledons, up to 4 cm. long; brownish-black.......................**Pichurim Majus**, 496.
Similar to last, but only about 2 cm. long, ovate; brownish-black ....**Pichurim Minus**, 496.
Round, flattish-ovate, plano-convex or irregular, somewhat contorted cotyledons; brownish or reddish-brown ....**Cola**, 497.

Group LXVIII

Arilli or Adventitious Seed-Coats

Fleshy, irregularly lobed and cleft bands, orange-brown; fragrant ....**Macis**, 498.

Group LXIX

Parts of Plants, Not Easily Recognizable as Such; Whole

Filiform, much-branched, horny, translucent thallus...**Chondrus**, 117.
Dark-brown or nearly black thallus with large air-vesicles ....**Fucus**, 119.
Long, round, stemlike, but without nodes and without cell differentiation within.................**Laminaria**, 120.
Mixture of several small sea-weeds.................**Corsican Moss**, 120.
Irregularly lobed lichens, brownish-gray above and grayish-white below ....**Cetraria**, 121.
Flat, brown lichen, with oval prominences on one side and corresponding depressions on the other side...**Sticta**, 122.
Fusiform, purplish-black grains, from 2 to 5 cm. long..**Ergota**, 123.
Irregular brown-black masses, partly membranaceous, partly pulverulent ....**Ustilago**, 125.
White, tough, light masses or fragments..............**Agaricus**, 126.
Brown, pliable, velvety sheets......................**Spunk**, 126.
Semi-fluid, viscid, frothy substance.................**Yeast**, 126.
Round, dark-brown masses, pulverulent within........**Puff-ball**, 127.
Light-yellow, very mobile and inflammable powder...**Lycopodium**, 128.
Flattish rhizomes, lobed, peeled, brownish, yellowish, or white from being limed.....................**Zingiber**, 241.
Narrow slices, up to 5 cm. long and 10 to 15 mm. wide; thickest in middle; yellowish-white..............**Scilla**, 262.

Slender cylindrical, sometimes curved pieces, spongy, white .... **Sassafras Pith**, 273.
Similar to last, but thicker and yellowish in color.... **Elder Pith**, 273.
Elongated, somewhat angular, scaly, unopened flower-heads, 2 to 3 mm. long; grayish-green.......... **Santonica**, 386.
Subcylindrical calyx-tube with 4 teeth terminated by a corolla forming a globular head; brown; fragrant .... **Caryophyllus**, 392.
Separate stigmas, or 3 attached to a style, linear-tubular, about 3 cm. long; deep reddish-brown.... **Crocus**, 405.
Cylindrical, about 4 to 5 cm. long and 5 mm. thick, spirally nodulated, stalked, grayish-brown........ **Piper Longum**, 420.
Oval or round grains, 2 to 4 mm. long, yellowish-white, whiter at ends, yellowish-brown groove along one side .... **Pearled Barley**, 466.
Ovate, fleshy, plano-convex cotyledons, about 2.5 to 3 cm. long and half as broad; yellowish.......... **Acorns**, 495.
Elongated or ovate, fleshy plano-convex cotyledons, from 2 to 4 cm. long; brownish-black.......... **Pichurim**, 496.
Fleshy, irregularly lobed and cleft bands, orange-brown, fragrant .... **Macis**, 498.
Round, hard, more or less nodulated, about 2 cm. in diameter; dark-colored .... **Galla**, 511.
Irregularly lobed, hollow thin-walled shells.......... **Chinese Galls**, 512.
Similar to last, but hairy and grayish.......... **Japanese Galls**, 512.
Round, spongy, orange or yellowish-brown, up to 5 cm. or more in diameter.......... **American Galls**, 512.

Group LXX

Parts of Plants Not Readily Recognizable as Such; Cut or Otherwise Altered

Cylindrical or cake-like masses, very hard, reddish-brown; odorless .... **Guarana**, 504.
Black pieces, having the structure of wood, but consisting mainly of carbon; or black, odorless and tasteless powder, not gritty.......... **Carbo Ligni**, 504.
Irregular brown-black masses, partly membranaceous, partly pulverulent .... **Ustilago**, 125.
White, tough, light masses.......... **Agaric**, 126.
Thin, brown, pliable, velvety sheets.......... **Spunk**, 126.
Small, conical, light-brown, peeled, or glossy, dark brown, unpeeled pieces of fronds mixed with pieces of rhizome; green within.......... **Aspidium**, 130.
Fragments of light porous roots, with thin grayish-brown bark under which is a net-work of lighter-colored fibro-vascular bundles.......... **Methysticum**, 175.

Short, brownish-gray sections, wood spongy and bark easily separable, and flaring at cut ends.......... **Stillingia**, 180.
Tough, spongy sections with irregular bundles........ **Sumbul**, 189.
Transverse and longitudinal sections of a thick fleshy root with radiating bundles; grayish-brown...... **Inula**, 192.
Large, round or plano-convex, orange-yellow pieces of root, peeled .... **Rheum**, 201.
Transverse sections, greenish-gray outer surface, yellowish on cut surfaces.......................... **Calumba**, 204.
Grayish-white transverse sections, hard, with prominent radiating and concentric lines.............. **Bryonia**, 205.
Decorticated roots, externally and internally white, mealy and fibrous............................ **Althæa**, 206.
Small, cubical, white pieces, about 3 to 4 mm. in size; peculiar odor .... **Althæa**, 207.
Longitudinal and transverse sections, with projecting white wood-bundles alternating with yellowish-gray parenchyma .... **Phytolaccæ Radix**, 207.
Obconical, blackish-gray, with shriveled lighter-colored rootlets; sometimes cut into halves or quarters longitudinally, or into transverse slices.......... **Veratrum Viride**, 215.
Obconical to subglobular, annulate, orange-brown; sometimes cut into transverse slices which are grayish-brown; slices sometimes strung on strings. **Trillium**, 217.
Longitudinal slices of rhizome, yellowish-brown, whitish within; show traces of nodes................ **Polygonatum**, 220.
Long, slender, yellowish-brown slices of rhizome; in section plano-convex or concavo-convex; taste aromatic .... **Calamus**, 239.
Thin, straw-like pieces, hollow, about 1 cm. long...... **Triticum**, 240.
Slender, nearly straight pieces, smoothly trimmed, 6 to 8 cm. long, white or cream-white, perforated to one end .... **Finger Orris**, 246.
Ovate, orange-brown disks or longitudinal slices of a thick rhizome; or circular transverse slices; odor and taste resembling ginger.................... **Zedoaria**, 247.
Kidney-shaped grayish-white slices.................. **Colchici Cormus**, 257.
Transverse slices with dark-gray epidermis and mealy-white surfaces .... **Arum**, 259.
Narrow slices, up to 5 cm. long, 10 to 15 mm. broad, yellowish, diaphanous, brittle.................. **Scilla**, 262.
Short, pale, grayish-green pieces of twigs, with smooth-cut ends; usually hollow......................... **Dulcamara**, 270.
Slender, cylindrical, sometimes curved pieces, spongy or pithy, white................................ **Sassafras Medulla**, 273.

An irregularly coarse, grayish-brown powder, mixed with many tough, coarse fibers.................. **Quercus Alba**, 349.
Leaves rolled into small pellets or cylinders, grayish-green, bluish-green to blackish.................. **Thea**, 359.
Separate stigmas, or three attached to a style, linear-tubular, about 3 cm. long; deep orange-brown with reddish tinge .... **Crocus**, 405.
Oval grains, about 2 to 4 mm. long, or round grains half as large, yellowish-white, whiter at ends, yellowish-brown groove along one side.................. **Hordeum Perlatum**, 466.
Orange-red, irregularly lobed, fleshy bands; fragrant; often broken .... **Macis**, 498.

Group LXXI

Trichomes

Vegetable Glands:

Granular, mobile, brick-red powder; no odor and little taste .... **Kamala**, 506.
Brownish-yellow to yellowish-brown powder; aromatic and bitter .... **Lupulinum**, 507.

Vegetable hairs:

Delicate white curling hairs, from 2 to 4 cm. long.... **Gossypium**, 508.
Glistening, brownish-red silky powder, consisting of hairs about 2 to 3 mm. long..................... **Mucuna**, 509.
Curling, glossy-brown, soft and delicate hairs, from 2.5 to 5 cm. long.................................. **Penghawar**, 133.

Liable to be taken for hairs or glands:

Irregular, brown-black masses, partly membranaceous, partly pulverulent .... **Ustilago**, 125.
Light-yellow, very mobile powder.................. **Lycopodium**, 128.

Hardly liable to mistake:

Separate stigmas, or three attached to a style, linear-tubular, about 3 cm. long; deep orange-brown with reddish tinge .... **Crocus**, 405.
Tufts of soft, silky, thread-like, yellowish fibers, about 15 cm. long; the ends often matted together and dark-brown .... **Zea**, 407.

Group LXXII

Excrescences

Round, hard, more or less nodulated, about 2 cm. in diameter; dark-colored; often with round holes.... **Galla**, 511.

Irregularly lobed, hollow, thin-walled, slightly downy or smooth, brownish............................**Chinese Galls**, 512.
Similar to last, but hairy and grayish..............**Japanese Galls**, 512.
Round, spongy, orange or yellowish-brown, up to 5 cm. or more in diameter............................**American Galls**, 512.

Group LXXIII

Starches

Polyhedric granules, often adherent in clusters; uniform, with well-marked hilum..................**Corn Starch**, 516.
Lenticular or oval, medium-sized and small granules; layers and hilum indistinct......................**Wheat Starch**, 516.
Ovate, large, layers very distinct; hilum at narrow end, small but distinct..........................**Potato Starch**, 517.
Polyhedric or angular, very small, uniform; hilum and layers indistinct ....**Rice Starch**, 517.
Ovate, medium-sized, layers and hilum distinct; hilum at broad end and often cracked or cleft..........**Arrowroot Starch**, 518.
Medium-sized, ovate, oblong, elliptic or irregular, often truncate at one end; layers and hilum distinct, the latter generally cleft.......................**Sago Starch**, 518.
Medium-sized, irregular, often muller-shaped granules; layers indistinct; hilum near rounded end........**Tapioca Starch**, 519.

Macroscopic appearance:

Small, round, pearly, white or brownish, opaque or slightly translucent lumps.......................**Sago**, 515.
Irregular lumps, white and opaque, or slightly translucent ....**Tapioca**, 515.

Group LXXIV

Acids

Colorless, right-rhombic crystals; deliquesce in moist air; acid taste.................................**Acidum Citricum**, 522.
Colorless monoclinic prisms, or crystalline crusts; permanent in air; acid taste......................**Acidum Tartaricum**, 522.

Groups LXXV and LXXVI

Inspissated Juices and Extracts

Inspissated Juices **(Group LXXV)**:

Irregular subglobular cakes, brown, with remnants of leaves or species of rumex fruit adhering to outer surface; heavy narcotic odor...................**Opium**, 525.

Hard, orange-brown, opaque masses, with resinous fracture; odor suggests saffron........................**Aloe**, 526.
Small, angular, shining, brittle pieces, ruby-red transparent in small fragments; odorless..............**Kino**, 527.
In quarter-sections of plano-convex cakes, or in irregular pieces; grayish-brown........................**Lactucarium**, 527.

Extracts (**Group LXXVI**):

Irregular, broken masses, brittle, dark-brown; sweetish astringent taste ....**Catechu**, 528.
Irregular lumps or small cubes, about 2.5 cm. in size, reddish-brown ....**Gambir**, 529.
Dark-brown, almost black cakes or fragments; often cakes enclosed in paper boxes...................**Logwood Extract**, 529.
In round, black sticks, with an impression of trademark at one end; or, in large black lumps; very sweet ....**Liquorice Extract**, 529.
Sometimes in flat, scaly fragments, more commonly as a thick extract-like mass, in jars................**French Lactucarium**, 530.

Apt to be mistaken for an extract:

Cylindrical or cake-like masses, very hard, reddish-brown; odorless ....**Guarana**, 504.

Group LXXVII

Sugars

White, hard, crystalline granules; very sweet.........**Saccharum**, 531.
Cylindrical crystalline masses; transparent, and very sweet ....**Rock Candy**, 531.
Yellowish granules or masses; sweet.................**Glucose**, 532.
Flattish, yellowish-white, porous flakes; honey-like odor and sweet taste...............................**Manna**, 532.

Bear in mind also the animal sugars:

Cylindrical crystalline masses; yellowish-white, opaque; sweetish ....**Saccharum Lactis**, 45.
Syrupy, sweet, aromatic, sometimes granular liquid....**Mel**, 48.

Group LXXVIII

Gums

Indistinct, transparent, crackled, colorless to yellowish or brown tears; soluble in water................**Acacia**, 533.
In wavy and curved flakes, whitish, translucent; swells in water ....**Tragacantha**, 534.

Group LXXIX

Gum Resins

Deep reddish or orange-yellow cylindrical solid or hollow pieces, or cakes; bright lemon-yellow when wetted or powdered............................ **Cambogia,** 536.
Greenish-black or dark-grayish, more or less porous masses .... **Scammonium,** 536.
Irregularly roundish tears, often hollow or enclosing foreign substances; yellowish or yellowish-brown.. **Euphorbium,** 537.
Brownish, sticky mass; containing whitish tears in a pinkish-brown substance; odor very fetid........ **Asafœtida,** 537.
In separate tears, or in masses, dirty white to pale-brown externally, bluish-white opalescent within; peculiar odor and bitter taste.................. **Ammoniacum,** 538.
Tears or masses, friable, reddish-brown, with fatty or waxy fracture .... **Myrrha,** 538.
Yellowish translucent tears, generally rough and powdery externally from attrition................. **Olibanum,** 539.
Small, whitish to yellowish-brown translucent tears, with peculiar odor and acrid bitter taste.......... **Galbanum,** 539.

Group LXXX

Resins

Roundish, pale-yellowish, transparent, brittle tears; becoming plastic when chewed...................... **Mastiche,** 542.
Elongated, pale-yellowish, transparent tears; crumbling when chewed .... **Sandaraca,** 543.
Roundish, yellowish or straw-colored transparent masses harder than rosin...................... **Dammara,** 543.
Irregular spherical or angular, yellowish to brownish pieces; transparent, hard...................... **Copal,** 543.
Brittle, dark reddish-brown, opaque lumps............ **Resina Draconis,** 544.
Brittle, dark reddish-brown, opaque sticks; often wrapped in palm-leaves....................... **Resina Draconis,** 544.
Irregular brittle masses, or large tears; greenish-brown to reddish-brown .... **Guaiaci Resina,** 545.
Small twigs surrounded by a brown-red resinous substance .... **Lacca,** 545.
Thin, brittle, brown or reddish-brown scales.......... **Shellac,** 545.
Roundish or flat, pale-yellowish to brownish-red pieces; dull exterior, glossy transparent within; hard.... **Succinum,** 546.
Yellowish or brownish, transparent, brittle masses.... **Resina,** 547.

Group LXXXI

Oleo-Resins

Transparent, more or less viscid liquid; yellowish-brown; peculiar odor and bitter acrid taste...... **Copaiba**, 548.
Tough, plastic, nearly solid yellowish mass; terebinthinate odor and taste.......................... **Terebinthina**, 549.
Soft, yellowish mass, granular within; odor fennel-like and taste terebinthinate........................ **Elemi**, 549.
Thick viscid, clear transparent, pale-yellowish liquid; odor terebinthinate .... **Terebinthina Canadensis**, 550.
Thick viscid liquid, similar to last, but turbid........ **Terebinthina Veneta**, 550.
Yellowish-brown opaque mass; plastic by warmth of hand, brittle when cold; conchoidal translucent fracture .... **Pix Burgundica**, 551.
Dark reddish-brown opaque mass; brittle when cold; fracture resinous, translucent, conchoidal........ **Pix Canadensis**, 551.
Thick blackish-brown, sticky viscid liquid, empyreumatic terebinthinate odor....................... **Pix Liquida**, 551.

Group LXXXII

Balsams

A solid brown mass with whitish tears imbedded in it; strong balsamic odor........................ **Benzoinum**, 553.
Nearly solid yellowish-brown substance of uniform consistence; strong balsamic odor.................. **Balsamum Tolutanum**, 554.
A thick, syrupy brownish-black liquid; somewhat smoky balsamic odor.......................... **Balsamum Peruvianum**, 554.
Thick, viscid, gray, opaque, semi-solid substance; with agreeable balsamic odor........................ **Styrax**, 555.
Thick, brownish-yellow, clear liquid, or almost solid substance; odor balsamic........................ **Liquidambar**, 555.

Group LXXXIII

Volatile Oils

A clear, limpid liquid with terebinthinate odor...... **Oleum Terebinthinæ**, 557.
List of volatile oils.............................. 557-562.

Group LXXXIV

Fixed Vegetable Oils and Fats

Solid Vegetable Fats:

Consistence of tallow, yellowish-white, odor of chocolate .... **Butyrum Cacao**, 564.
Consistence of tallow, mottled white and brownish, odor of nutmeg .... **Butyrum Nucistæ**, 564.
Solid diaphanous substance resembling white wax.... **Paraffinum**, 565.

Bear in mind also the animal fats:

Hard, white, somewhat glossy masses (see Group VI). **Acidum Stearicum**, 44.
White solid, fatty masses (see Group VI)........ **Sevum**, 44.

Semi-solid fats:

Of the consistence of butter or lard, granular, green.. **Oleum Lauri**, 565.
Of the consistence of butter, white; disagreeable odor.. **Oleum Cocois**, 566.
Of the consistence of butter, orange-colored; violet-like odor .... **Oleum Palmæ**, 566.
Of the consistence of a cerate or ointment, yellowish; slightly fluorescent .... **Petrolatum**, 566.

Bear in mind also the animal fats:

Soft, white, unctuous fatty substance (see Group VII). **Adeps**, 47.
Soft, yellowish white fatty substance (see Group VII). **Adeps Lanæ**, 47.

Liquid Oils:

Thin, clear, pale-yellow oil with nutty odor and bland taste .... **Ol. Amygdalæ Expr.**, 567.
Pale yellow oil without odor, and with a bland nutty taste .... **Ol. Gossypii Semenis**, 567.
Yellowish to yellowish-brown oil, with peculiar odor and bland taste........ **Ol. Lini**, 567.
Pale yellow, or light greenish-yellow oil; peculiar odor and nutty taste........ **Ol. Olivae**, 568.
Viscid, nearly colorless oil; odor mildly nauseous, taste bland but afterwards acrid........ **Ol. Ricini**, 568.
Yellowish oil, odorless, and with a bland, nutlike taste. **Ol. Sesami**, 569.
Yellowish-brown to deep brown, somewhat viscid; odor unpleasant and taste acrid........ **Ol. Tiglii**, 569.

Bear in mind also the animal oils:

Yellowish to brownish oil with fishy odor (see Group VIII) .... **Ol. Morrhuae**, 49.

Pale yellowish or colorless fixed oil (see Group VIII). **Ol. Adipis**, 50.
Pale yellow to yellowish-brown oil (see Group VIII).. **Ol. Bubulum**, 50.

Group LXXXV

Peculiar Concrete Substances

White, translucent, crystalline masses; peculiar penetrating odor and bitterish pungent taste......... **Camphora**, 570.
In cakes, balls, hollow bottle-shaped or irregular pieces, blackish-brown, very elastic.................... **Elastica**, 570.
Grayish or yellowish-gray masses, streaked interiorly; not markedly elastic........................... **Gutta Percha**, 571.
Light friable, grayish-green flattish fragments; taste acrid bitter .... **Elaterium**, 571.

Group LXXXVI

Coloring Matters

More or less firm, brittle masses; blue to purplish; insoluble in water................................ **Indigo**, 572.
Small, rectangular, blue or bluish cakes; colors water blue .... **Litmus**, 572.
A purplish-red powder, imparting a beautiful color to diluted alcohol .... **Persio**, 573.
Thick, deep reddish-purple liquid, with ammoniacal odor .... **Orchil**, 573.
Usually an orange-red paste; sometimes dry and friable cakes .... **Annatto**, 573.

THERAPEUTICAL TERMS

Abortifacient: Causes abortion.
Acid: Neutralizes alkaline condition of blood.
Adjuvant: Assists action of main remedy.
Aliment: Nutriment or food.
Alkaline: Neutralizes acid condition of blood.
Alterative: Gradually improves nutritive processes.
An., **Ant.**, or **Anti**: A prefix meaning "opposed to."
Anæsthetic: Produces loss of sensation.
Analgesic: Relieves pain.
Anaphrodisiac: Reduces sexual desire.
Anodyne: Relieves pain.
Antacid: Neutralizes acid condition of blood.
Antalkaline: Neutralizes alkaline condition of blood.
Antarthritic: Against gout and rheumatism.
Antasthmatic: Relieves asthmatic attacks.
Antemetic: Checks vomiting.
Anthelmintic: Kills intestinal worms.
Antidote: Counteracts action of poisons.
Antigonorrhœic: Cures gonorrhœa.
Antihysteric: Opposed to hysteria.
Antilithic: Prevents formation of stone in bladder.
Antinephritic: Beneficial in kidney troubles.
Antiperiodic: Cures malarial fevers.
Antiphlogistic: Reduces excessive bodily temperature.
Antipyretic: Reduces excessive bodily temperature.
Antirheumatic: Of benefit in rheumatism.
Antiscorbutic: Against scurvy.
Antiseptic: Prevents putrefaction; destroys germs.
Antispasmodic: Relieves cramps and spasms.
Antisquamous: Against scaly skin diseases.
Antistrumatic: Against scrofula.
Antizymotic: Prevents fermentation or contagion.
Aperient: A gently purgative remedy or diet.
Appetizer: Improves appetite and digestion.
Aphrodisiac: Increases sexual vigor and desire.
Aromatic: Spicy; stimulates appetite and digestion.
Aseptic: Free from disease germs.
Astringent: Contracts tissues; checks secretions.
Bitter: With bitter taste; stomachic and tonic.

Blennorrhetic: Increases mucous secretions.
Carminative: Expels flatus from bowels.
Catalytic: Same as alterative.
Cathartic: Purgative; stronger than a laxative.
Caustic: Destroys or burns tissues by chemical action.
Chalybeate: Contains iron in solution.
Cholagogue: Increases flow of bile.
Conspergative: Dusting powder.
Corrective: Prevents disagreeable action of drugs.
Corrosive: Destroys tissues.
Cosmetic: Preparation to beautify skin, etc.
Counter-Irritant: Checks pain by external irritation.
Deliriant: Produces delirium.
Demulcent: Allays irritations; used internally.
Dentifrice: For cleaning teeth.
Deobstruent: Removes obstructive accumulations.
Deodorant: Destroys foul and unhealthful odors.
Depilatory: Removes superfluous hairs.
Depressant: Sedative; allays irritability.
Depresso-Motor: Lowers activity of motor nerves.
Diaphoretic: Increases perspiration.
Disinfectant: Destroys infectious germs.
Diuretic: Increases secretion of urine.
Drastic Cathartic: A powerful purgative.
Ecbolic: Aids in child-birth by contracting the womb.
Eccritic: Promotes secretions and excretions.
Eliminant: Promotes excretions.
Emetic: Causes vomiting.
Emetico-Cathartic: Causes vomiting and purging.
Emmenagogue: Stimulates menstrual functions.
Emollient: Allays irritation; used externally.
Errhine: Increases nasal discharge.
Escharotic: Destroys tissue and produces scar.
Evacuant: Increases evacuations.
Excipient: Gives flavor or consistence to medicines.
Excitant: A stimulating remedy.
Excito-Motor: Stimulates motor nerve-centers.
Expectorant: Increases expectoration (from bronchi).
Febrifuge: Cures fevers.
Galactagogue: Increases flow of milk from breast.
Gargle: For rinsing throat.
Germicide: Destroys disease germs.
Hematic: Acts on and through blood.
Hemostatic: Arrests hemorrhage.
Hydragogue Cathartic: Causes profuse watery stools.
Hypnotic: Produces sleep.
Inebriant: Produces inebriation.

Insecticide: Destroys insects.
Irritant: Causes irritation.
Laggniappe: Gratuity to a purchaser.
Laxative: Mild cathartic.
Lenitive: Soothing; slightly laxative.
Lithontriptic: Dissolves calculi in bladder or kidney.
Motor-Depressant: Lowers activity of motor nerves.
Motor-Excitant: Stimulates motor nerve-centers.
Mydriatic: Causes dilatation of pupil of eye.
Narcotic: Depresses and may destroy nerve action.
Nauseant: Produces nausea and relaxation.
Nephritic: Beneficial in kidney troubles.
Nervine: Nerve stimulant and tonic.
Neurotic: Acts on and through the nerves.
Nutrient or **Nutritive**: Nourishing.
Parasiticide: Destroys parasites.
Parturient: Facilitates child-birth.
Poison: Impairs health; may destroy life.
Protective: Aseptic or soothing dressing for wounds.
Purgative: Cathartic; evacuates bowels.
Refrigerant: Cools; allays heat and thirst.
Restorative: Restores tissues to healthy condition.
Rubefacient: Counter-irritant; reddens the skin.
Sedative: Allays nervous irritability.
Sialagogue: Increases flow of saliva.
Solvent: Dissolves morbid secretions and deposits.
Somniferant: Produces sleep.
Soporific: Produces sleep.
Spinant: Muscular excitant through spinal nerves.
Sternutatory: Causes sneezing.
Stimulant: Increases functional activity.
Stomachic: Stimulates appetite and digestion.
Styptic: Arrests hemorrhage.
Sudorific: Increases perspiration.
Suppurant: Causes suppuration.
Tænicide or **Tænifuge**: Destroys tapeworms.
Tonic: Promotes nutrition.
Topical: A local remedy.
Vaso-Motor: A vascular stimulant.
Vermifuge: Destroys and expels intestinal worms.
Vesicant: Produces blisters.
Vulnerary: Useful in healing wounds.
Zymic or **Zymotic**: Caused by fermentation.

POSTSCRIPT

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COLLEGE BOTANY: Bastin.
LESSONS AND MANUAL OF BOTANY: Gray.
TEXT BOOK OF BOTANY: Sachs.
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It is the hope of the author that this work on pharmacognosy may be of service to students of pharmacy, as well as to the active pharmacist, for whose use in the daily routine of business this book has mainly been written.

O. A. WALL.

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